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THE TINGGIAN.[1]

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(From the Field Museum, Chicago, and the Bureau of Science, Manila, P. I.)

INTRODUCTION.

For several years the Field Museum of Natural History has been desirous of making a thorough investigation of the various Philippine peoples; but it was not until 1906 that money was available for this purpose. Through the generosity of Mr. Robert F. Cummings, of Chicago, ample funds were provided for a series of investigations to extend through four or six years. The first party to begin work under this appropriation reached the Islands in June, 1906, and was followed by a second in January, 1907.

Influenced by the evidences of a highly developed ceremonial life found by Mr. Dean C. Worcester, during his visits to Abra, and by the suggestions of Dr. Paul C. Freer and Dr. Merton L. Miller, the writer decided to make the Tinggian the initial field for work. The studies carried on have been along the lines of general ethnology (with special emphasis placed on the material culture, social organization, customs, religion, mythology, and decorative art), language, and physical anthropology.

The following article lays no claim to completeness, as the investigations are still in progress; yet it seems advisable, from time to time, to publish such material as may be of interest to workers in other fields.

[1] The name Tinggian is spelled throughout this paper in accordance with the form adopted by the division of ethnology of the Bureau of Science. In all native Philippine words in which the hard sound formerly represented by "c" occurs this sound is represented by "k," as in "Ilokos."

GEOGRAPHICAL DISTRIBUTION AND MIGRATIONS.

The Tinggian culture group has its stronghold in the subprovince of Abra. To the north and west, it extends into Ilokos Sur and Norte as far as Kabittaoran (near Dingras). Manabo, to the south, on the Abra River, is the last pure Tinggian municipality; but Barit, Amtuagan, Gayaman, and Luluno are Tinggian mixed with Igorot from Agawa and Sagada. Villaviciosa is an Igorot settlement from Sagada and its vicinity; but Bulilising (near Villavieja) is strongly Tinggian. I am told that Sigay in Amburayan is largely made up of Tinggian emigrants from Abra, and that a few rancherias in Lepanto are also much influenced. In Ilokos Sur, south of Vigan, the whole non-Christian population is commonly called Tinggian, and the people readily apply the name "Itneg" (the name by which the Tinggians distinguish their own people) to themselves. A careful survey, however, shows that very few true Tinggian towns exist in that section. A small number are of mixed Tinggian and Igorot population, while the balance are Igorot, somewhat influenced. I failed to find any Tinggian towns south of Santa Lucia. North of this point are Ballasio, Nagbuquel, Vandrell, Rizal, Mision, Mambog, and Masinget. Towns of mixed population are Kadangla-an, Pila, Kolongbuyan (Sapang), and Montero. The other villages are Igorot colonies from Titipan, Sagada, and Fidilisan.

Along the headwaters of the Saltan River in Balbalasang, Talalan, Sesekan, Patikian, and Salegseg, we find a people who in dress and looks are much like the Tinggians, and they are generally so classed. These people claim a common ancestry with those of Linas, Gakab, Malibkum, and the Gobang group who originally came from Bolalay-yo (near Patikian). There has been considerable intermarriage with the Igorots, and extensive migration into the Tinggian belt, but very little movement from Abra to this section. The Gobang group (including the villages of Bo-ok, Kapnay, Dewangen, and Kayabong), which is the least influenced of any of this region, must, I believe, be classed with the Kalinga. It seems, then, that here we are dealing with a population made up of Tinggians, Igorots, and Kalingas, but that, with the exception of dress, the Tinggian influence is insignificant.

In the extreme northern end of the island, in the vicinity of Bangui and Claveria, and again along the Apayao River is a people who call themselves "Ishneg," and who closely resemble in size, features, and color the people of Abra. Commissioner Worcester first indicated his belief that these people were wild Tinggians. With a view of gathering more data on this point, the writer visited these regions in the early months of this year. The material from this section has not been carefully worked over; but there is much to indicate that these people are of common stock with the people of Abra. However, the separation must have taken place at a remote period, before the Tinggian received the

highly developed ceremonial life which distinguishes him from his neighbors. Because of the many differences in customs, and the space allowed this article, no attempt will be made to deal with the Apayao branch at this time.

It is difficult to secure reliable information concerning the Tinggians in early and pre-Spanish times; but all the tales of migrations tell of movements from the coast country far back into the mountains, as the pressure of the "Christians" was felt. In many cases there was a return to the lower valleys from which these people are again being slowly driven by their Ilokano neighbors. They have no tales of an earlier home than Luzon; but the Apayaos have well-defined stories of having come from the Babuyanes (to the north of Luzon) settling near Pamplona, Abulug, Nagilyan, and Aparri, and to have reached their present home since the advent of the Spaniards.

The migration into Abra from the vicinity of Sagada has already been noted. A second, considerable movement took place from Balatok to the Ikmin River Valley, where the emigrants founded the towns of Danok, Amti, and Doa-angan. Tue is a settlement direct from Balbalasang; and the towns lower on the Buklok River have received many additions from there, also from Gina-an and Lubuagan. All of the villages on the headwaters of the Binongan have received emigrants from the Kagayan side; while Agsimao and other towns of the Tineg group are largely made up of Kalingas and Apayaos. There is an approximate population of twenty thousand in the towns properly classed as Tinggian (Apayao excepted).

PHYSIQUE, DRESS AND CUSTOMS.

The center of the Tinggian belt is reached from Vigan, in Ilokos Sur, by a trip on a raft which takes a day, or on horseback along the Abra River. From Bangued as a center, the settlements radiate in all directions. To the north and east, they extend two and three days' trips into the mountains. A few of the larger municipalities are in the broad valley of the Abra or its main tributaries, where with extensive fields and domesticated animals the Tinggian has not only successfully competed with his Ilokano neighbors, but has often surpassed them. In the mountains, his efforts have been more restricted; but with his terraced fields he has managed to bring much of the rugged country under cultivation. Even the steep mountain sides, where irrigation is impossible, are cleared, burned and planted to corn and mountain rice.

The rivers contain quantities of small fish, eels, and shrimp, and many are the devices employed for their capture. By nature the man is a hunter; and he is poor, indeed, who does not own one or more dogs for use in the chase. In the leisure season, following the rice harvest, it is a common sight to see ten or a dozen men with their spears, nets and

dogs starting for the mountains, and at nightfall returning with the game swung on bamboo poles between them.

The outdoor life has given the Tinggian almost a perfect physique. The average man is about 5 feet 4 inches in height. He is neither slight nor heavy; but his muscles are full and smooth, giving him the appearance of a trained athlete. The woman measures about 4 feet 8 inches, and like the man, is well and roundly developed. In both sexes, one is impressed with the strength of the features. The forehead is high and vaulted, the eyes are wide set and moderately open, the nose, higher than that of most Luzon peoples, compares with that of the Chinese, although the flat root and concave ridge is by no means uncommon. The skin varies from a light to dark reddish-brown; but here, again, the average Tinggians are readily distinguished from the other wild tribes by their lighter color. The hair is a glossy brown-black and is slightly wavy.

The dress of the man is the clout and a belt in which he keeps small articles, about the waist. On special occasions he wears a long-sleeved jacket and in a few cases, trousers. The hair is worn long and is parted straight down the middle; the two strands are twisted, crossed in the back, then carried to the forehead where they are again crossed, and the ends are fastened by intertwining at each side of the head. A bark headband holds the hair in place. Round hats are commonly worn. The woman's hair is parted in the middle and combed straight down to the nape of the neck where it is caught by strings of beads; these are crossed in the back and encircle the head; the strand of hair is then twisted and a loop formed which is carried to the left side, where it is caught under the beads above or near the ear. Strings of beads are also worn about the neck; but the typical ornament consists of strands above strands of beads reaching from the wrist to the elbow, and if the wealth of the owner permits, even covering the upper arm as well. The strands are fastened tightly above the wrist, causing that portion of the arm to swell. Slits of bamboo are usually placed under the beads when they are put on, and these may be removed, relieving the arm, if the pain or annoyance of the constriction is too severe. The upper arm beads are removed with little difficulty; but those on the forearm are taken off only once in three to five months, when new threads are substituted. The woman's arm is usually tattooed beneath these ornaments; this the Tinggians say is done so that when the beads are removed during mourning, her arms may not be white and unsightly. Most of the women have their ears pierced, but in the valley towns only a small proportion wear earrings. In the mountain sections, heavy ornaments of gold or copper are worn, often drawing the lobe far down on the cheek. When at work, the woman discards all clothing from the upper portion of her body, but at other times, she generally wears a short-sleeved waist. A narrow skirt (*dingwa*) with colored border extends from the waist to

the knees; beneath this is a girdle of braided grass or rattan to which a clout is fastened. The women seldom wear hats unless at work in the fields, where sunshades large enough to protect the entire body are worn. Frequently, a cloth or *dingwa* is twisted about the head to protect it from the sun.

Both men and women blacken the teeth with iron salts and tanbark; and most of the former have tattoo marks on the thigh, hand, or forearm. Ordinarily this is the mark with which the Tinggian brands his animals so that he may easily prove his property.

The Tinggian has availed himself of the material most easily obtained for house building. Six or eight small logs planted in the ground, form the framework on which the floor supports, sides and beams may be tied or fitted. Closely tied bamboo slits form a floor, and halved bamboos the sides. On the upper frame the builder puts a large mat of coarsely woven bamboo; above this is placed cogon grass, bound down by bamboo strips, and the building is complete. The floor is 4 or 5 feet above the ground and entrance is gained by a bamboo ladder which leads up to an uncovered porch built in front of the door. Inside the door, at the left, one usually finds the stove (three stones sunk in a box of ashes or dirt), or a similar device of clay. Above the fire is suspended a hanger on which are placed dishes and food in order that they may not be disturbed by insects. Along the wall stand a small caldron, the jars for water and rice and the large Chinese jars, the latter as a general rule heirlooms or marriage gifts. These are sometimes used for basi, but more often they contain broken rice, cotton, or small articles. Above the jars is a rack or hanger on which dishes or coconut shells are placed. At the end of the room a cord supports a variety of clothes, blankets, a woman's switch, and perhaps a man's belt. The sleeping mats either hang here or occupy a rack of their own. Below the cord stand old boxes, secured in early years by trade with the Chinese. In these are the family treasures, valuable beads, coins, blankets, ceremonial outfits and so forth. Piled on the boxes is a variety of pillows, for no Tinggian house is complete without a number of these. The other house furnishings, consisting of a spinning wheel, loom, coconut rasp and a chair or two (these are greatly prized), find space along the other wall. Behind the door, except in the valley towns, stand the man's spear and shield. Above or near the door will be the spirit offering in the form of either a small hanger or a miniature shield fastened against the wall. The center of the floor affords a place for working, eating and sleeping. Carts, tools, and the like are put under the house or in one of the spirit structures near by. This description will cover the majority of Tinggian houses; but buildings with two rooms, one used for cooking, are by no means uncommon and structures, the sides and floors of which are made entirely of carefully hewn planks, are frequently met with.

A number of small houses and structures erected for the spirits are

found in each town. The largest of these, which is nearly of the size of a dwelling, but which has no sides, is known as *balao-a*; another closely resembling it, but much smaller, is *kalangan*; while a third, comparable in size but without a pointed roof, is *tangpap*. A miniature house built near a rice granary, some banana trees, or in a distant field, is *bawi*. Four poles (three usually of bamboo, and one of a resinous tree) support a small platform several feet above the ground, and this is known as *pala-an*. A bamboo pole about 10 feet long has one end split into several slits; these are forced apart and tied with twisted bamboo, and into the basket thus formed a jar or coconut shell is placed, while decorations of leaves and rice stalks are added. These poles, known as *saloko,* are commonly found planted at the entrance of the town. Miniature baskets of this nature hold an egg, and are fastened to the roof of a house. Coconut husks decorated with feathers and containing the legs and head of a chicken, are suspended from a pole; they are known as *baneet* (fishhook). In addition to these permanent spirit structures, a number of small buildings are made for special ceremonies and are destroyed after they have served their purpose. The *balao-a* and *kalangan* are used as general meeting places for the women when they spin or weave, cotton is beaten there and tobacco is hung in them to dry.

Aside from these buildings and the houses, a Tinggian village will contain a number of corrals for carabaos and cows and a few gardens and seed beds. Surrounding the settlements are the rice bins.

It has already been noted that the Tinggian has extensive rice fields. To these he devotes the greater part of his time. When the rains begin, the seed beds are planted, fences are repaired; and when the soil has become moist, it is plowed and harrowed. Both men and women work at transplanting the rice; but the men watch and care for the fields during the season of growth. When the grain has ripened, the whole population goes to the fields to cut and bind the rice and to carry it to the inclosures for drying. From June to November much of the day is spent in the paddies, but it is the happy time for the people. Approaching a group of workers, you can hear one or more singing the *daleng,* in which they tell of current events or topics of general interest, or perhaps some youth is singing a love song to the girls.

Aside from rice, the Tinggian raises maize, tobacco, beans, sugar-cane for *basi* (the native fermented drink), *camotes* (sweet potatoes) and *aba* (*gabi*) in considerable quantities. Many other vegetables and roots as well as fruits are used for food to a considerable extent.

Many excellent baskets are made; these are chiefly the work of the man. The woman is the potter and the weaver of nearly all the clothes and blankets used by the family, and she also plaits the mats. All household duties are left to her; but when at home the man will

assist in the care of the children, especially the babies. Hunting and fishing employ the man's extra time.

During the dry season bonfires are built at night in various parts of the village; about these the women will gather to spin and the men to make nets, while some good singer or story teller will entertain with tales of the adventures of some mythical hero, of contests with strange huge animals, or of beings with supernatural power.

GOVERNMENT.

The old men of a village constitute its ruling class. Of this number, there is usually one who by reason of his wealth, integrity, or superior knowledge of the customs, is called *Lakay,* and to him, all matters of dispute are brought for adjustment. If the case is of importance, or difficult to settle, he will summon the other old men who will deliberate on and decide the questions at issue. They have no means of enforcing their decisions on the people other than that it is custom to obey, and the offender is ostracized until he has met the conditions imposed. A pig and a jar of *basi* are furnished for such a gathering and the person judged to be in error must stand the cost of the meeting. A young man has little or no voice in the conduct of affairs; even his own life and actions are largely regulated by his older relatives. The woman seldom participates in the general councils, but in daily life she is quite as independent as her husband and with him has equal rights to bring her grievances to the attention of the *Lakay.*[2] The wealth and the standing of a man's ancestors in a community have much to do with his position and power, but age outweighs all other considerations. Since the American occupation local self-government has been established in many of the towns. The contest for office and government recognition of the officials is tending to break down the old system and to concentrate the power in the *presidente.*

In daily life there is no strong class distinction (with the exception of the *pota*), but during ceremonies and functions, one class is sharply marked. The members of this are known individually and collectively as *alopogan;* for lack of a better name, I shall call them mediums. There is no organization to this class: men or women who are named by the spirits to become *alopogan,* either through other mediums, in

[2] An exception to this is the *pota,* a class made up of those women who live with men not their husbands. Such a woman is held somewhat in contempt by the other women; and she is seldom seen at the camp fire gatherings or in other houses. Her children belong to the father; and she has no right of appeal to the old men, except in cases of cruelty. Men with concubines do not suffer in the estimation of their fellow-men, but are considered clever to be able to have two or three women in addition to their wives. The *pota* is usually faithful to one man, and prostitution, as such, is almost unknown.

dreams, or by trembling fits when they are not cold, go to one already accepted by the *anitos* [3] and from her learn the duties which they are to perform. First there are long *deams,* or set prayers, which the spirits taught the first Tinggians. These must be memorized word for word. Then the objects desired by each spirit must be learned, so that no visiting *anito* may be offended by failure to receive his regular gift. The greatest task is to learn the details of the various ceremonies of which there are more than twenty, varying from a half day to seventeen days in duration. Many months or even years may be required to learn all the things which must be done. When all is mastered, the candidate must secure her *peling.* These are a certain variety of sea shells which are put in a small basket with a hundred fathoms of thread. If it is possible she will use the *peling* of some dead medium but failing to secure them new shells will be obtained. A small pig is killed; and its blood, mixed with rice, is offered to the spirits. The liver of the animal is eagerly studied, for it will give the sign whether or not the *anitos* are satisfied with the new medium. Should the liver be spotted, further preparation or offerings are desired and until a favorable sign is received, no attempt is made to summon the spirits. Certain candidates are never accepted by the *anitos*; but they are not barred from making the *deams* and aiding in the direction of ceremonies.

If the signs are favorable, the medium may now conduct ceremonies alone and summon the spirits. She places the offerings before her on a mat and after striking a dish repeatedly with her *peling* (to call the attention of the spirits) she covers her face with her hands and trembling violently, begins to sing, calling on the *anitos* to enter her body. Suddenly she becomes possessed of a spirit and is no longer herself: all her actions are those of a higher being, and as such she talks with the people, asking and answering questions, or directing what shall be done to drive away the sickness for which the ceremony has been made. At one time only can she summon the spirit of the dead; just as the body is to be lowered into the grave, the spirit may possess her and through her, talk to his relatives.

The pay of the medium is small—usually a portion of some animal slaughtered for the ceremony, a few bundles of rice and some beads; but the taboos are severe. At no time may a medium eat of carabao, wild pig, wild chicken, or shrimps, nor may she touch peppers.

RELIGION.

To understand the Tinggian at work or at play, it is necessary to understand his religion, for to him it is very real, influencing every act of his daily life. A great and powerful spirit known as *Kadaklan* lives in the sky, and to him all other spirits are subservient "like soldiers."

[3] Spirits *sui generis.*

His wife, *Agemem,* who lives in the earth is also powerful. Two sons have resulted from this union, and they are quick to punish any disobedience of their father's commands. *Kaboneyan* is the friend and helper of the people. It was he who taught the Tinggians how to plant and to harvest, how to overcome evil signs and to foil the designs of ill-disposed spirits. His cave in the mountains contained the wonderful tree on which grew the agate beads so prized by the women; in it lived the jars which could talk and move; while from the same cave came all the valuable *gansas*[4] which the people use. Nearly all the details of ceremonies and celebrations were taught by this friendly spirit. Further to bind himself to the people, he married "in the first times" a woman from Manabo. More than a hundred and fifty other spirits, some good, some evil, are known by name and at some time or other they visit the people through the mediums.

In his waking hours the Tinggian does not fear many of the spirits. He converses freely with them when they come to the ceremonies; to the friendly ones he shows the utmost respect; to the ill-disposed, he is insolent, makes fun of them, or lies to and cheats them. At night his attitude is changed. In the darkness he is no match for the unseen beings and every door and window is tightly closed to keep them out. If by chance he is compelled to sleep on the mountain or in the open he takes every precaution to ward off their evil machinations. *Sobosob*[5] leaves should be his bed, for this plant is distasteful to the spirits; branches put at his head will avert an early death by preventing one of them from expectorating on him as he sleeps. No work nor trip of importance is planned without first observing the signs and even when the undertaking has been begun an evil omen will cause a change or a postponement. Offerings of food and drink are made at the beginning and the completion of an important work, whether it be the planting and harvesting of the rice, or the completion of a house or field. When illness visits a member of the family, it is the work of an *anito* and the medium is called. She prepares for the ceremony which she thinks is needed and the spirits are summoned. Should she have erred in the selection of the ceremony the proper one will be substituted. The many spirit houses mentioned earlier in this article demand ceremonies of varying lengths, and are visited by many spirits. *Balao-a, kalangan, tangpap,* and often *pala-an* demand several days for their completion and are visited by nearly all the spirits, including the most powerful.

The spirit of a dead man is called *Kalading.* It may go at once to its home *Maglawa*—somewhere in the sky—or it may remain nearby until the body is buried. Often it stays close to the house to punish any member of the family who leaves the town before the ten days taboo is

[4] Gongs of copper.

[5] *Blumea balsamifera* DC.

passed. It returns for the *làyog,* a ceremony made about six months or a year after the death, and sometimes on other occasions. The *kalading* resembles a person, but can not be seen and in *Maglawa,* he lives much as he did on earth. For that life, he needs clothes, food and utensils, and the family of the dead man never fail to put these in a box above the grave. There is no idea of reward or punishment in the future life; neither does the *kalading* return to earth in any other form. The dead are not worshiped, and aside from the one *layog*—described later—no ceremonies or offerings are made after the funeral.

Magic is known and practiced by many of the people. Strange dances and songs sung under a house can bring illness to its occupants. Some article of clothing belonging to the victim is put in a section of bamboo and placed near the fire to give him fever. Any article just handled by an enemy, or the dust of his foot prints when covered with poison, will bring him sickness or death. The folk-tales abound with stories of heroes who could call on the power of their head-axes, shields, or betel-nuts to transport them from place to place in an instant, to transform them into birds and animals, and to bring dead men to life. Many methods are used to detect a person practicing magic or doing wrong. The most general is to place an egg on the edge of a bolo or split bamboo, then ask the question. If the answer is "Yes," the egg will balance; otherwise it will fall. The top of a jar or the *peling* belonging to a medium is suspended by a cord and the question put: if the answer is "Yes," the article will swing, otherwise it will remain quiet.

BIRTHS AND MARRIAGES.

Children are much desired by the Tinggian, and every precaution is taken to guard the child from evil spirits. About the time a birth is expected, two or three mediums are summoned. A mat is placed in the middle of the floor and the spirit offerings are placed on it. Near the door a pig is tied and over this the mediums make *deam.* When they have finished, one of them pours water in the pig's ear, "so that as it shakes the water out, so may the evil spirits be thrown from the room." An old man cuts open the body of the live pig and thrusting in his hand he draws out the still palpitating heart which he gives to the medium. With this she strokes the abdomen of the expectant woman, so that the birth may be easy, and also as a protection against all evil. The slaughtered animal is soon prepared for food and the friends of the family eat and drink. When the meal is finished, the mediums begin to call the spirits, several of whom will come. One of these *anitos* acting for all the others makes *gepas* (the division) with an old man. The medium who is now possessed by the spirit puts a blanket called *enalson* over her shoulders; a head-ax is given to her and another to the old man. A pig is brought in, and to its head and tail is tied a

narrow strip of cloth. After much debating the middle of the pig is decided upon and each seizes a leg with the left hand. The animal is raised from the floor and with the axes in their right hands they cut it in two. In this way the mortals pay the spirits for their share in the child and henceforth they have no claim on it. The women bring *basi* and the spirit drinks with the old man to cement the friendship. Other spirits are summoned until nightfall.

When the delivery takes place, the mother is attended by one or two women who knead the abdomen and assist in the removal of the child. The afterbirth is put in a jar and is intrusted to an old man who must exercise the greatest care in his mission and in his choice of a place for its disposal. Should he squint while the jar is in his keeping, the child will be thus affected. A book or letter inserted in the jar will cause the child to be very wise; while a few leaves of bamboo make the child grow like that lusty plant. If the afterbirth is hung in a tree near the trail, the infant will not be afraid; if hung in the jungle, he may fear men, but will become an excellent hunter. Often the river is chosen or the jar is buried: the former will result in an excellent swimmer and fisherman; but it is ill-fortune for the baby if the pot is put in the ground, for he will be afraid to climb a tree or to ascend a mountain.

Very soon after birth the child is washed and placed on an inverted rice winnower and an old man or woman gives it its name. The winnower is raised a few inches above the floor and the woman asks the child its name, then drops the winnower. Again she raises it, pronounces the name, and drops it. A third time it is raised and the child is advised to be obedient and industrious; a third time it falls, and the naming is complete. A Tinggian child is always named after a dead ancestor; often it receives two names, one of a relative on the father's and one on the mother's side. A third name, that of the day or month or one commemorating some occurrence at the birth, is frequently given.

Marriages are contracted for very young children. When the youth's parents have decided on a suitable girl, they send a relative who is able to "talk much and well" to broach the subject to the maiden's people. It is then his duty to explain the many desirable qualities of the youth and his family and to get consent for the union. If the suit is favored, a bead is fastened on the girl's wrist, and arrangements are made for the *pakalon*. This is a function to which the friends of the contracting parties are invited; food and *basi* are prepared and on the appointed day the townspeople and guests from neighboring villages come in numbers. The relatives form a circle to talk over the price which the girl should bring, and after a discussion often lasting nearly an entire day, a list is prepared. The payment usually consists of horses, carabaos, jars, blankets and a small amount of money. A portion of this is paid

on the day of *pakalon* and is distributed to the girl's parents and relatives; but the balance is often left unpaid until the man's death. However, no division of his property can be made until the marriage agreement is paid in full. The children usually receive the unpaid portion of the marriage gift, as well as all the property possessed by the father at his death; if there are no direct heirs, the wife's relatives receive the balance due on the marriage list, while the man's relatives receive the remainder of his property. The completion of the list is the signal for great merriment; *basi* circulates freely; the men sing *daleng* and *tadek* is danced far into the night. The music for this dance is made with three *gansas* and a drum. The *gansas* are pressed against the thighs of the players who kneel on the ground. Two of the coppers are beaten with a stick and the palm of the hand, while the third is played by the hands alone. The stick or left hand gives the initial beat which is followed by three rapid strokes with the right palm. A man and a woman enter the circle each holding a cloth about the size of a *dingwa.* The man extends his cloth toward the woman and bringing it suddenly down causes it to snap, which is the signal to begin. With almost imperceptible movement of the feet and toes and a bending at the knees, he approaches the woman, who in a like manner goes toward him. They pass and continue until at a distance about equal to the start, when they again turn and pass. Occasionally the man will take a few rapid steps toward the woman with exaggerated high knee action and much stamping of the feet, or he will dance backward a few steps. At times the cloth is held at arm's length in front or at the side; again it is wrapped about the waist, the woman always following the actions of the man. At last they meet: the man extends his hand, the woman does likewise, but instead of taking his, she moves her own in a circle about his, avoiding contact. Again they dance away only returning to repeat the performance. Finally she accepts the proffered hand, the head man brings *basi* for the couple to drink and the dance is over. The man sometimes ends the dance by the sharp snapping of his cloth, or by putting it on his extended arms and dancing toward the woman, who places her cloth upon his.

After the *pakalon* the children stay with their parents until they are old enough to live together. The age for the final ceremony depends entirely on the wealth of the boy's family. If he is able to care for the girl, the marriage often takes place before either of the children reach puberty: in case the boy must earn a living, the marriage may not be consummated until he is eighteen or nineteen years of age.

When the time for the ceremony to be completed has arrived, the boy goes in company at night to the girl's house. In place of the customary bolo, he wears a head-ax, but he is the only one so armed. He carries

a valuable jar which he gives to his parents-in-law; and from that time on he must not call them nor any near relative of the girl by name, or he will have boils and the first child born will be crazy. He also presents them with ten pesos which is part of the agreed price. The girl's people have prepared a dish of rice and a shell cup of water, and the couple sit on opposite sides of these on the floor. The boy's mother puts two beads into the water and each of the couple take a drink from it. Great care is taken not to shake the cup, or they will get dizzy, and when old their heads and hands will shake. The two beads always go to the bottom of the cup together, and so the couple will not part; the cold water keeps them from getting angry. After they have drunk, each takes a handful of rice and squeezes it firmly into a ball. The girl drops hers through the bamboo floor as an offering to the spirits, but the boy tosses his into the air. If the ball breaks, it is a bad sign and the couple are apt to part. Often the marriage is deferred and tried again a few days later; repeated breaking of the ball would cause an annulment of the agreement. If the ball rolls, it is not a good sign as they may be unfaithful. Should it go under the boxes and jars, their children will die. If the ball remains intact and does not roll, the signs are most favorable and all will go well. If at any time during the proceedings a thing should fall or be broken in the house, the ceremony is stopped at once; to proceed that night is to court trouble, but a few days later they will try again. The guests now depart. No food nor *basi* is given nor is there any kind of a celebration. For two days the couple are subject to strict taboos, a violation of which would cause disaster for themselves or their children. The month following the marriage they live at the girl's house, after which they go to the home prepared by the boy or to that of his parents. They are accompanied by the groom's mother and go very early in the morning so that the birds can not give a bad sign. The girl carries her mat, blankets, and two pillows with her. Before she can eat of her husband's rice, he must give her a string of beads or she will be sick: she may not open his rice granary until a like present has been given or the spirit of the granary will make her blind.

If at any time the relatives of the girl have reason to doubt the husband's affection they may make *nagkakalonan*. They carry a pig, jar and a number of baskets to the house and spread them on the floor. In order to prove his love, the man must exchange money and presents for them, after which a pig is killed and eaten by the guests. Should the old men decide that there was no cause for doubt, the relatives must pay the cost of the gathering and the husband does not exchange anything with them. No trace of the clan system is to be found, but marriage is prohibited between blood relatives.

FUNERALS.

The death of a child is followed by little or no demonstration, but when an adult has expired elaborate ceremonies follow. The corpse is dressed in good clothes and is placed in a death chair. Before it two or three old women sit both day and night to wail and guard against evil spirits who may wish to harm the dead, or his spouse. The bereaved dons old clothes, and with a white blanket thrown over her,[6] sits in one corner of the room behind a barricade of pillows. Thus placed she is more easily protected from evil *anitos* who are sure to use every device to take her life as well. Above the corpse a cord is stretched and on it blankets and other gifts are placed so that the spirit of the dead man may carry them with him to his ancestors in Maglawa. Offerings of *basi,* food, chickens and pigs are made to the different spirits who always attend a funeral with evil intent. Other animals are slaughtered for food and until sunset of the succeeding day the friends eat and wail. There is neither music, singing, nor dancing. Burial is under the house. It is customary to reopen the grave of the dead man's ancestors and there to inter the body. Just at sunset the grave is in readiness (this is the common, but not universal time for burial). The greatest excitement prevails as the medium sits down in front of the body and summons the spirit. As it enters her body she falls back in a faint, in which condition she is allowed to remain for a moment; then fire and water are brought; the spirit is driven away and she gives the last messages to the family. A mat is wrapped tightly about the corpse and four men bear it from the house to the *balaoa.* It is rested near the spirit structure for an instant on its way to the grave, for *Kaboneyan* told the first Tinggians that unless they did that the spirit would be poor in *Maglawa* and unable to build *balaoa.*

That night the men gather and sing *Sangsanget,* a song in which they tell of the dead man, encourage the widow and pray for the welfare of the family. All that night and the succeeding nine days and nights a fire is kept burning near the grave to keep away the evil spirit, *Ebwa.*

The morning after the burial the relatives construct a bamboo box and place in it the clothes, utensils and food which the spirit will need in the future life. This is hung above the grave and the whole is surrounded by a bamboo fence.

Soon after this, the blood and oil ceremony is made, for until the wife and relatives have been anointed with blood and oil, they may not eat of anything except corn, neither may they swing their arms nor touch anything bloody, and all work is tabooed.

The spouse of the dead continues to wear old clothes until the *layog* is made. This ceremony, which is celebrated in six months or a year,

[6] The procedure is the same for men or women.

makes the family forget their sorrow and also shows their respect for the dead. Invitations are sent to the neighboring towns and on the appointed day a great crowd has gathered. A medium goes to the guardian stones of the village and there offers rice mixed with blood to the spirits, oils the stones, and after dancing *tadek,* returns to the gathering. Rice, pigs, cows or carabaos are prepared for food, while *basi* flows freely. A chair containing the clothes of the deceased and offerings for his spirit is placed near the house ladder. In the yard, four crossed spears form the framework on which a shield rests and on this are beads, food, and clothes—offerings for the spirits. According to the wealth of the family, the guests for one or two days remain eating, singing, dancing or indulging in games. The mat of the dead person which, until now, has remained spread out in the house is rolled up, the doors and windows which have been kept closed since the funeral are thrown open, and the family don their good clothes and make merry with the guests.

CONCLUSION.

This brief sketch of some of the more important incidents in the life of the Tinggian can not well be closed without a word concerning his relation to his nearest neighbor, the Ilokano. The writer was early impressed by the similarity between the Ilokano of the outlying barrios and the Tinggian. As the various dialects were studied, it was strikingly evident that we were dealing with primitive Ilokano. The work in physical anthropology yielded much the same results. The people of isolated Christian barrios corresponded almost exactly to their wild neighbors, while those in the larger towns showed the influence of intermarriage with other peoples. In developing the genealogical tables it soon became evident that the non-Christians had many relatives in the civilized communities, and further search revealed the fact that many of the leading Ilokano families of Bangued, and through them of Vigan, were only four or five generations removed from the Tinggians. The Ilokano still retains many of the customs and beliefs of the older generations, and a study of these shows many of them to be almost identical with those of the Tinggian.

What the future may have in store for this people must be determined largely by the influence wielded by the schools over the younger generation. In those towns where the Ilokano influence has been the strongest, the Tinggian has been undergoing a certain amount of degeneration physically, industrially and morally. By nature he is industrious and if his energies can be directed without his acquiring the vices of his "civilized" neighbors he will become a useful member of the community. The first great step toward this end was taken when Commissioner Worcester succeeded in establishing an industrial school for Tinggian boys in Lagangilang (Abra).

ILLUSTRATIONS.

PLATE I.

FIG. 1. Lagangilang, Abra.
2. Boy on a carabao.

PLATE II.

FIG. 1. Transporting logs and bamboos.
2. Building a house.

PLATE III.

FIG. 1. Inclosure for drying rice; granaries in the background.
2. Woman pounding rice.

PLATE IV.

FIG. 1. Preparing tobacco for curing.
2. Making pots.

PLATE V.

FIG. 1. Tinggian cane press.
2. The sirup vats; basi making.

PLATE VI.

FIG. 1. Medium making *deam* before the guardian stones.
2. Building the spirit house, *Tangpap*.

PLATE VII.

FIG. 1. Mediums summoning the spirits.
2. The spirit talking to mortals.

PLATE VIII.

FIG. 1. Family group.
2. Portrait of Tinggian.

PLATE IX.

FIG. 1. Portrait of Tinggian.
2. Portrait of Tinggian.
3. Portrait of Tinggian.
4. Portrait of Tinggian.

FIG. 1.

FIG. 2.

PLATE I.

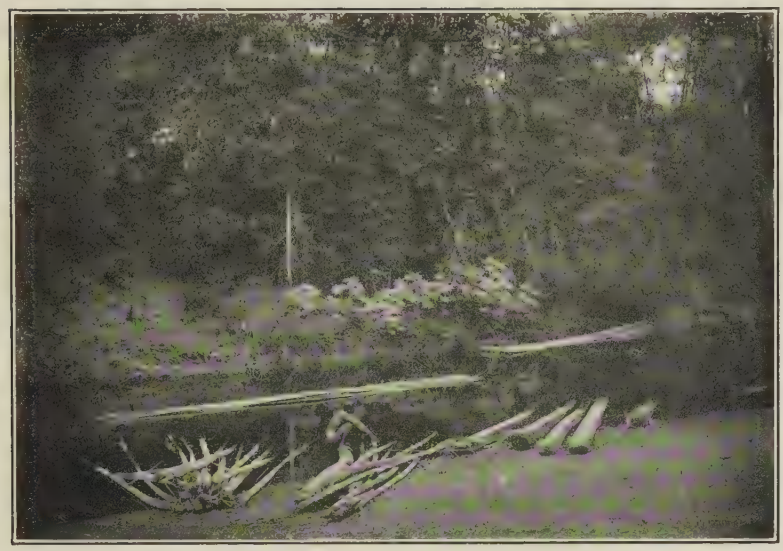


FIG. 1.

FIG. 2.

PLATE II.

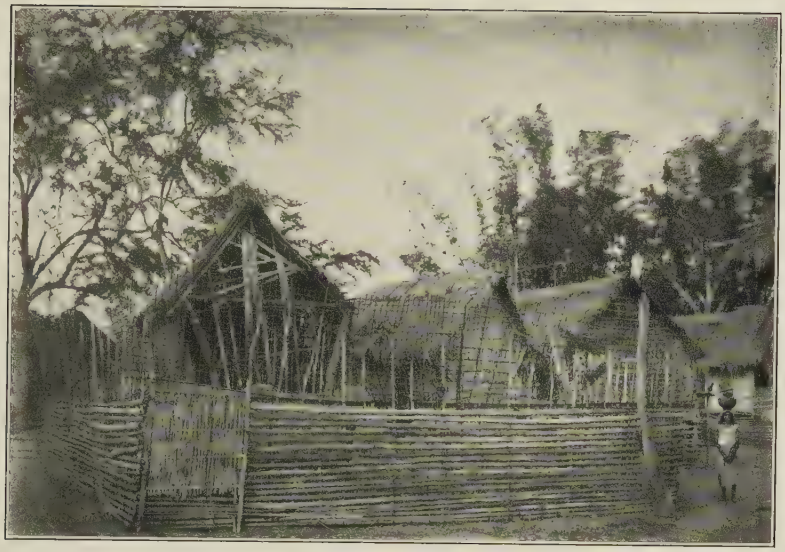


FIG. 1.

FIG. 2.

PLATE III.

FIG. 1.

FIG. 2.

PLATE IV.

FIG. 1.

FIG. 2.

PLATE V.

FIG. 1.

FIG. 2.

PLATE VI.

FIG. 1.

FIG. 2.

PLATE VII.

FIG. 1.

FIG. 2.

PLATE VIII.

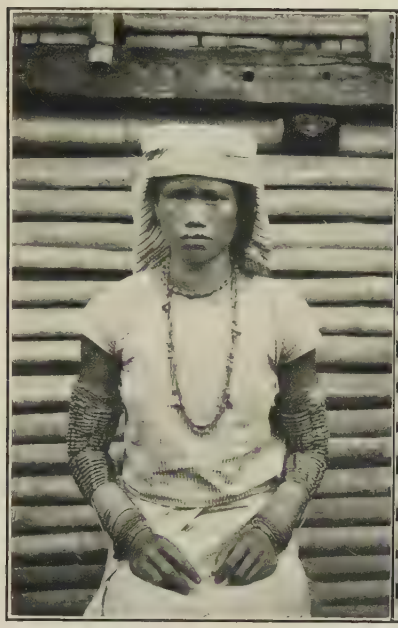


FIG. 1.

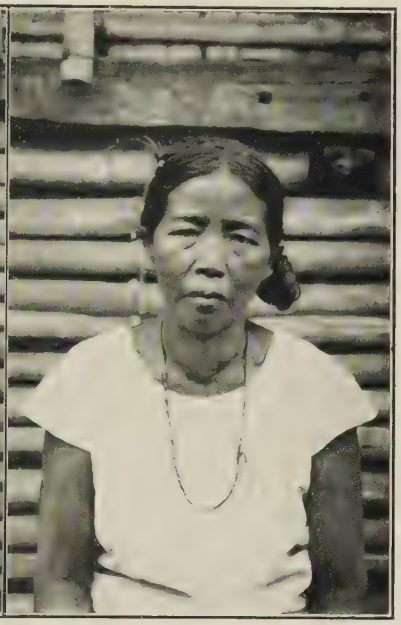


FIG. 2.

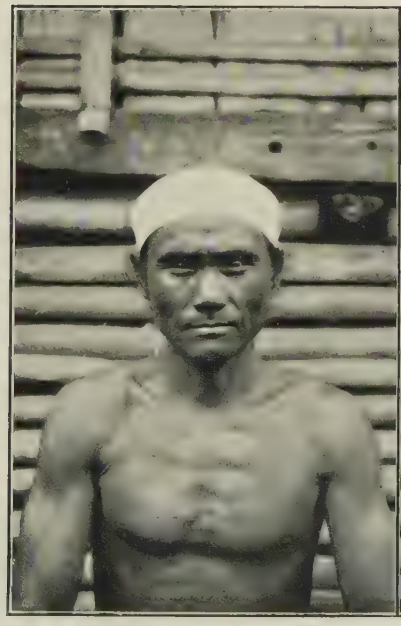


FIG. 3.

FIG. 4.

PLATE IX.

A THEORY OF HEREDITY TO EXPLAIN THE TYPES OF THE WHITE RACE IN NORTH AMERICA.

By Robert Bennett Bean.[1]
(*From the Anatomical Laboratory, Philippine Medical School, Manila, P. I.*)

The classification of the types of man is a stumbling block for anthropologists. The basis of such a classification varies with different authors and few agree as to what constitutes a type, a race, a stock, or a family of men. No attempt is made in this paper to define these different terms, but the word type is used to represent a composite entity that is homogeneous in a group of individuals.

ARRANGEMENT OF DATA.

The results recorded in this paper are based on measurements made on more than 1,000 students (923 boys, 116 girls) at the University of Michigan in 1905, 1906 and 1907, all of whom with few exceptions were members of the freshman class.

The physical attributes fall naturally into several groups, such as cephalic index, pigmentation, height, etc., and the types readily assemble with these attributes as limitations. There are four primary types, four secondary, and five blended ones.

CLASSIFICATION OF TYPES.

The most prevalent type is termed the "Northern" throughout this paper, because it originally appeared in northern Europe, now predominates there and is designated as Northern by many authors, although it is identical with the Cymric race of Broca, the *Homo Europeus* of Lapouge, and the Teutonic (Germanic) or race of the "row graves." This type is tall, fair haired, light eyed and dolichocephalic, and it occurs in 18 per cent of the boys and 22 per cent of the girls.

The second of the primary types is designated the Iberian (Pl. I), because of its evident derivation from the Iberian of Great Britain and Europe. This is the Mediterranean race of Sergi, the southern Europe or *Homo meridionalis* of Ripley and Lapouge; in fine, the Hamitic stock

[1] Read at the Fifth Annual Meeting of the Philippine Islands Medical Association, Manila, February 28, 1908.

that spread in earlier times over Africa, Asia and Europe and filled the "long barrows" of Britain. The Iberian of America is above the average in stature, very dark haired and dark eyed, and dolichocephalic, and the type appears in 16 per cent of the boys and 18 per cent of the girls.

The third primary type is that of the Celt of Broca, the Middle European, Rhetian, Celto-Slav, Ligurian or Celto-Ligurian of certain anthropologists, the *Homo alpinus* of others. The name Alpine is used in the present article. The physical characteristics are medium height, moderate pigmentation (brown hair and eyes), and brachycephaly, and the type is found in 10 per cent of the boys and in 10 per cent of the girls.

These three types represent three primary elements in the population of Europe and are believed by many to be the three primitive white stocks, but there is an additional type, which, with its two secondary types, is distinct and characteristic of a large element of the American population. This is the broadheaded Saxon of Beddoe, and the Oriental or eastern European of Deniker. The present inhabitants of northeastern Europe and middle western Asia conform to this type, which is above medium height, has fair hair and eyes and is brachycephalic, occurring in 9 per cent of the boys and in 9 per cent of the girls. It is hereafter referred to in this article as Saxon.

The two secondary types closely associated physically with the Saxon are the Celtic and Vistulian, the former being like an extreme Saxon in large proportions, the latter resembling the same type in the opposite direction, being the smallest physically of all the types. In Great Britain the Celt (Pl. II) is the muscular, tawny gaint of history, the Kelt of English writers, the prehistoric man of the "round barrows," with a height exceeding that of the Northern type, which is noted for this feature, a cephalic index greater than that of any other, and very fair hair and light eyes. This type occurs in 2 per cent of the boys and 2 per cent of the girls.

The Vistulian is Deniker's type of that name, so called from its apparent predominance along the Vistula River. This type is very short in stature, has fair hair and light eyes, is mesocephalic, and is found in 4 per cent of the boys and 4 per cent of the girls.

These three types, Saxon, Celtic and Vistulian, may be variations of one original, but there are distinctions such as height, cephalic index, class standing, etc., that render them clearly separate and different at the present time.

The two remaining secondary types, the Littoral and Adriatic, bear the same relation to the Iberian and the Alpine respectively as the Celtic bears to the Saxon, and one might select from the Iberian and Alpine each a type bearing the same relation to them that the Vistulian

bears to the Saxon. In like manner, the Northern type might be subdivided into three—an extremely large, an extremely small, and an intermediate one. Each of the four primary types would then be resolved into three, but the distinctions are slight in all except the Celtic, Vistulian, Littoral, and Adriatic, and these four last named are described and located in Europe in the recent work of Deniker, so there is justification in the grouping given above. Whatever may be said in regard to the secondary types, no just objection can be made to the four primary ones.

The Littoral type (Pl. III) corresponds closely with the "Mediterranean Race" of Houzé, the Cro-Magnon of some authors, and the Littoral or Atlanto-Mediterranean of Deniker, and usually appears in Europe not more than 120 to 150 miles from the coast. The type is *very* tall, has *very* dark hair and eyes, is mesocephalic, and occurs in 3 per cent of the boys and 5 per cent of the girls.

The final secondary type is Deniker's Adriatic or Dinaric, tall, dark and brachycephalic, and it may belong to the Lorraine race of Collignon. It is present in only 2 per cent of the boys and not at all among the girls.

The blended types are apparently mixtures of two or more of the primary or secondary ones. Blend No. 1, or Celt-Iberian (Pl. IV), which is above the average in height, has the largest chest of all, intensely black hair, light blue or gray eyes, and is mesocephalic. This is present in 8 per cent of the boys and in 3 per cent of the girls, representing a well known so-called "Irish" element in America, but found there also in other than the Irish population. It is probably a blend of the primitive Iberian of the "long barrows" in the British Isles and the later arrivals, or Celts, of the "round barrows."

The individuals of Blend No. 2, or Northern-Iberian, are very tall with dark hair and light eyes (the latter often green) and are extremely dolichocephalic, with a cephalic index lower than any other type. This is probably a blend of the Iberian and Northern type, and occurs in 5.5 per cent of the boys and in none of the girls.

The third blended type, Blend No. 3, is probably largely Alpine with an admixture of Northern, and might be called Northern-Alpine. It is of medium height, mesocephalic, with light brown eyes and blonde hair, and is found in 4 per cent of the boys and in 3 per cent of the girls.

Blend No. 4, is very rare and is largely Iberian, or Saxon-Iberian. It is below medium height, has dark hair and light eyes, is brachycephalic, and occurs in 1 per cent of the boys and 4 per cent of the girls.

Blend No. 5 is a conglomerate with a preponderance of Saxon elements, but also with evidences of Iberian, Northern and Alpine and may be considered a composite American type, toward which all others tend. It is of medium height or slightly taller, with light brown or sandy hair,

eyes of all the lighter shades, namely, blue, gray, green, light brown or hazel, and a mesocephaly characteristic of the English people. It is present in 13 per cent of the boys and in 20 per cent of the girls.

In addition to these, 15 Jews and 7 mulattoes were included in my study at the University of Michigan.

FEMININE TYPES.

Although only 116 girls were measured, the types are so nearly like those of the boys, with a reduction in height and an increase in cephalic index, that a few words regarding sexual affiliations and differences may not be out of place.

One most striking result of a comparison of boys and girls by type is that the mean has a greater range of variation among the girls than among the boys. The differences between the means of the types is greater for girls than for boys, except in height, where the boys have greater variability.

TABLE I.—*Differences of type means.*

Sex.	Weight.	Height.	Chest.	Pigment.	Head.			Cephalic index.	Brain weight.	Class standing.
					Length.	Breadth.	Height.			
Girls	18.2	13.7	10.0	66.0	1.6	0.99	0.60	7.3	100	20.0
Boys	10.7	15.6	3.8	53.4	0.7	0.65	0.41	5.6	59	13.8

This may have a broad significance, especially when it is known that the variability of the girls is in the direction toward the supposed precursor, the male tending toward a common mean, the female toward the primary stock. This would reconcile the conflicting views of many biologists with Pearson's school of biometricians, the first claiming man to be more variable than woman, the second, the opposite. Pearson and his followers have made observations by "random sampling" and, working on the mean of such samples regardless of type or individual, have necessarily overlooked that which a more detailed and intricate study reveals. Variability is indeed greater in a "random sample" of women than in one of men, but it may be true only because women tend to remain true to the original type, while men vary toward a common mean. If further research corroborates this conclusion, a factor of prime importance is added to the principles of heredity. This is one of the many indications of the postulate that heredity is a persistance of type with modifications, and the modifications may be greater among men who must become habituated to surroundings, while persistance of type is more evident in women who are more or less shielded and become modified more slowly. There seems to be a sexual difference in intellect, the Iberian being the male leader and the Saxon the female leader, while the Alpine is apparently not so vigorous as the

others either physically or mentally. The above observations are suggestive, not final.

To summarize the feminine types, it may be said that the height, weight, chest girth and head size are less for the girls than for the boys, while the class standing and the cephalic index are greater. The feminine types correspond fairly well to the masculine ones of the same kind, with minor differences.

The fact that the same types can be collected from a hundred girls as from a thousand boys, in nearly the same relative proportion as to number and with similar physical differences, speaks well for the types selected as representing realities. Head size, particularly frontal width and class standing, are correlated, but cephalic index and class standing show no correlation.

There is a slight indication that the girls may be more nearly like the aboriginal types than the boys, because the blonde girls are fairer and the brunette girls are darker; the height of the girls is relatively nearer that of the primitive types than is the height of the boys; the chest girth of the girls is also closer to the original. The cephalic index, head length and width, places the long-headed girls relatively nearer to dolichocephaly than the long-headed boys, and the broad-headed girls are decidedly more brachycephalic than the broad-headed boys.

The head shape of the girls is shorter, broader and higher, with prominent frontal and occipital regions, due partly to small brow ridges and small occipital protuberances. This gives a square, vertical forehead similar to those of the Iberian boys, the shape of which is due to the same factors.

TYPE HEREDITY.

A tentative scheme of heredity, or of the processes that are transforming the physical characters of man, is formulated for the first time in this paper, in order to throw light upon the existing types of the white people and to assist in tracing their origins, as well as to determine some of the forces at work in shaping the formation of new types. The scheme embodies the principles of determinate variation, alternate variation and discontinuous variation, and applies these principles in a practical way to explain type heredity in man. It is briefly as follows:

An original germ plasm contained all (?) the possibilities of life. Certain innate tendencies influenced by surrounding conditions caused variations from time to time (determinate variation) until a type became too differentiated and specialized (evolution) to exist, and perished (paleontology). The germ plasm persisted. Man is at present one of the differentiated and specialized living forms. Types of man have been produced favorable to the surrounding conditions (isolation), and the crossing of these types blends definite characters and again disengages them, each of the blended characters returning, more or less pure, in succeeding generations (alternate variation). After characters be-

come highly specialized, losing some qualities and gaining others by a process of elimination and accretion, the crossing of types containing such highly specialized characters may unite apparently dormant qualities in each type and produce a new type unlike either of the original, this being called a mutation, a sport of reversion (discontinuous variation). Heredity then is like producing like, with modifications, or simply descent with variability.

Heredity has three factors, a determinant, a modifier, and a law of chance, and these three regulate variation, or heredity acting through environment.

The determinant, or the germ plasm, which has direct descent from the germ cell of one generation to that of the next, has its activities expounded by Weissmann, Galton, and Brooks, under the designation of Weissmann's theory of heredity.

The modifier has been variously set forth as selection by Darwin, use and disuse by Lamarck, strength of parts by Roux, organic selection by Mark Baldwin, Osborne and Lloyd Morgan, and isolation and other factors by many other biologists.

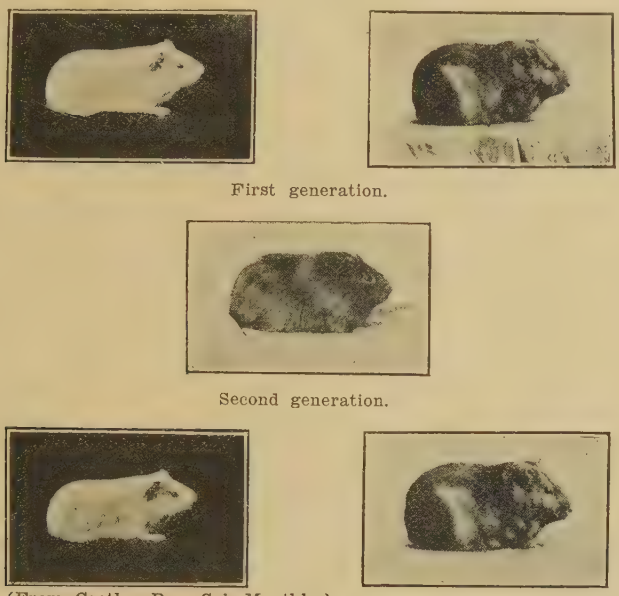
The law of chance is Mendel's law, or that of alternate variation, as elaborated by Castle, Bateson and others and exemplified by the inheritance of male from female and vice versa, through the specificity of the accessory chromosome, as identified by Henking, McClung and Wilson, as well as by certain hereditary affections such as color blindness, peroneal atrophy, congenital cataract, hemophilia, alcaptonuria and other abnormal characters, like two joint digits, web fingers, etc. These usually show either dominant or recessive characteristics and are as a rule inherited by the male through the female, the latter not being affected.

The law of chance is the law by which the determinant acts, and environment is the modifier.

Mutation, or fluctuating variability, may be explained as the action of the modifier on the determinant by accumulated and oft repeated variation in a definite direction (determinate variation), as represented by the paleontologic records of the horse; and then the unexpected crossing of long separated and specialized germ plasm or individual characters, gives rise to reversions, sports, or mutations. Continued intercrossing of differentiated characters, or specialized germ plasm, causes fluctuating variability. Determinate variation, fluctuating variability and mutation are processes illustrating the modifications of the determinate factor.

Mendelism represents the action of the two extremes of a single character when crossed, such as black and white hair, long and short hair, smooth and tufted hair, etc. In the first generation of such a cross the dominant factor obscures the recessive and all appear to be dominant, but in the next generation of a cross *inter se* the recessive factor reappears, and always in a definite proportion. When black and white

guinea pigs are crossed the second generation is all black, but the third generation has three black and one white (fig. 1).



First generation.

Second generation.

(From Castle: Pop. Sci. Monthly.)

Third generation.

FIG. 1.—Effect of crossing white and black guinea pigs.

The white is pure and breeds true. Only one of the blacks will do this, however, because the other two are hybrids like the second generation. There is an equal distribution of both dominant and recessive elements, although the apparent relation is three dominant to one recessive. The distribution follows the law of chance as illustrated by H. H. Newman in his lectures at Ann Arbor on heredity, or by the use of colored discs. Put equal numbers of black and white strips of paper into a receptacle and draw out one in each hand noting each time what is produced, whether two white, two black, one white in the left hand, one black in the right, or one white in the right hand and one black in the left. An equal number of each of the four possibilities will result if this process is continued indefinitely. However, Mendelism represents something besides the law of chance, because the dominant obscures the recessive, and the law holds true for individual cases, while only in the ultimate result can the law of chance be tested. Mendelism may be the method of readjustment of individual characters when they are brought together by crossing after their extreme limit of variability has been reached.

Blending does not begin at once, but only after repeated crossing has taken place. This may be explained by the action of the chromosomes in the germ cells. When the ovum has rid itself of unnecessary chromosomes and has conjugated with the spermatozoön to regain the chromatic equilibrium of its kind (type), then all the hereditary powers that produce

the individual are present. Whatever further development takes place is caused by the chromosomes acting through the environment. When the first few cell divisions take place there may be little influence from environment, but the greater the number of cells, that is, the further away they are from the original one, the greater is the influence of environment and the greater becomes the differentiation of the individual cells. During a long series of generations of an individual species (type), the changes produced even in the germ cells by division, growth and nutrition must be so great and the ultimate germ cell so far removed from the original one that the supposition of its unaltered condition is untenable, and this is true without considering the manifold influences on the germ plasm during the life of each individual. A germ cell may separate itself from the other cells almost at the beginning of the segmentation of the ovum (fig. 2), and in this way carry on directly

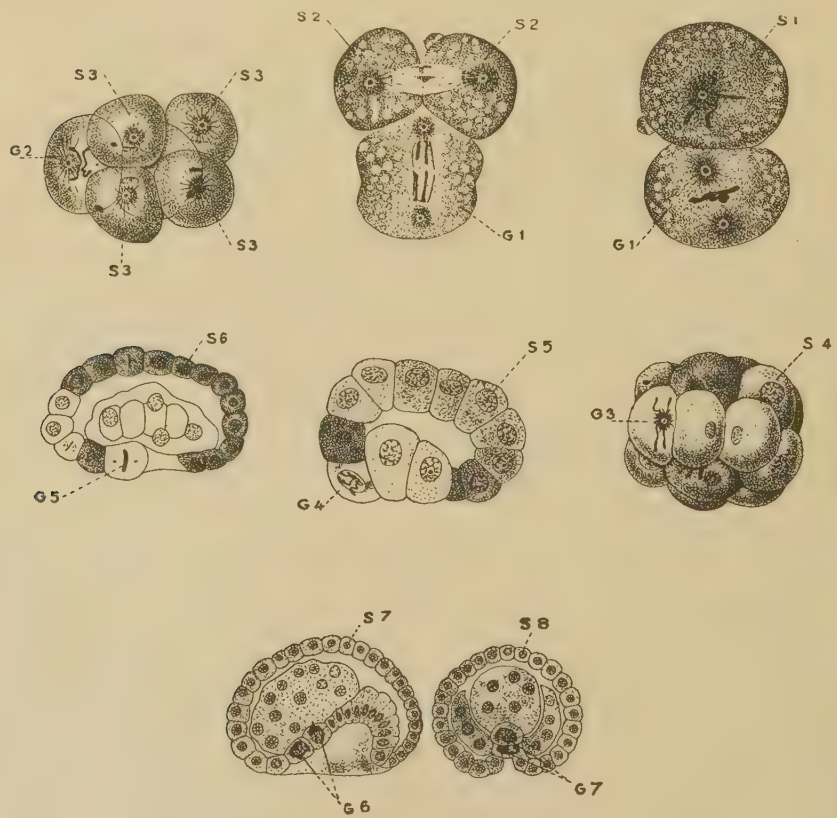


FIG. 2.—Segregation of the sex cells in the segmentations of the ovum after fertilization. *Ascaris megalocephala* var. *univalens*. (Adapted from Buck's Reference Handbook of the Medical Sciences, 1902, 4, 650. After Boveri.)

The germ plasm divides by doubling division (growing in bulk and dividing) so that each resulting mass is precisely like the other. One of these may divide repeatedly, always doubling, and remains unaltered germ plasm (G 1–2–3–4–5–6–7) going to that part of the individual from which new organisms arise (ovary in woman, testicle in man.) The germ plasm is thus handed on directly from generation to generation.

The second portion of the germ plasm (somatic cell) (S 1–2–3–4–5–6–7–8) undergoes differentiation division, and controls the building of the individual.

to the succeeding generation the chromosomes of the two parents, but the physical and chemical impossibility of the single cell containing all the necessary determinants for all possible forms of life is readily perceived. The germ plasm may be acted upon by environment, as would be indicated by the effect of intoxicants (in a broad sense such intoxicants as alcohol, bacterial toxins, internal secretions, diathesis, etc.), in the hereditary transmission of tendencies and in producing monsters, epileptics, etc. Therefore, the immortality and immutability of the germ plasm must be acknowledged to be inconceivable.

Adami's scheme, which is a combination of Ehrlich's side chain theory and Mendelian heredity, is a good graphic representation of the chromatic relations of the germ cells. Each germ cell has a central ring

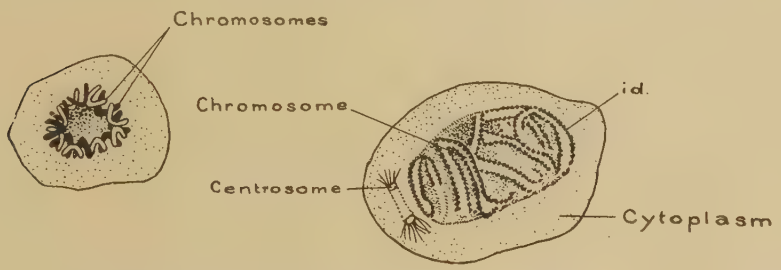


FIG. 3.—Weissmann conceives that the chromosomes which produce an individual consist of many *"ids"* each of which contains all the possibilities of a new organism. The *"ids"* possess an historic architecture that has been slowly elaborated during the multitudinous series of generations that stretch backward in time from every living individual. Each *"id"* consists of determinants which represent the various parts of the individual that may undergo variation, and each determinant is composed of biophores which enter the cells and direct their vital activity.

with side chains to which are linked affinities (fig. 4). The chromo-

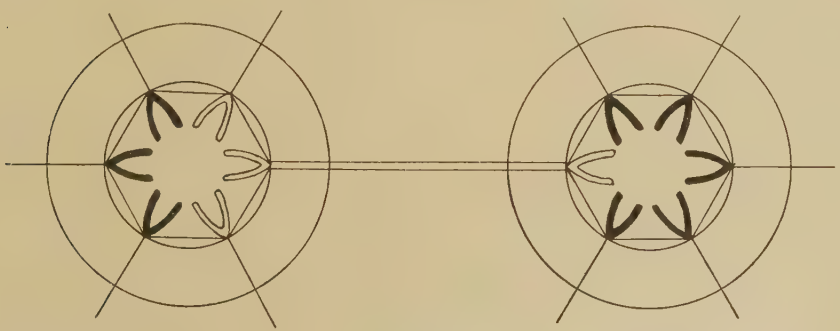


FIG. 4.—Adami considers that the germ cells are similar in nature to the benzene ring. The chromosomes represent the side chains that link together affinities. Like chromosomes attract like. Unlike chromosomes repel each other, but may finally fuse after repeated contact through many generations.

somes represent the side chains. The central ring does not alter, but the side chains may. Sex cells or germ cells contain the original side chain unaltered. Liver cells, muscle cells, etc., contain many side chains.

Environment begins its action when cell division commences, the environment of each cell becoming different from that of its predecessor. In this way the side chains become changed and heredity is affected (fig. 5).

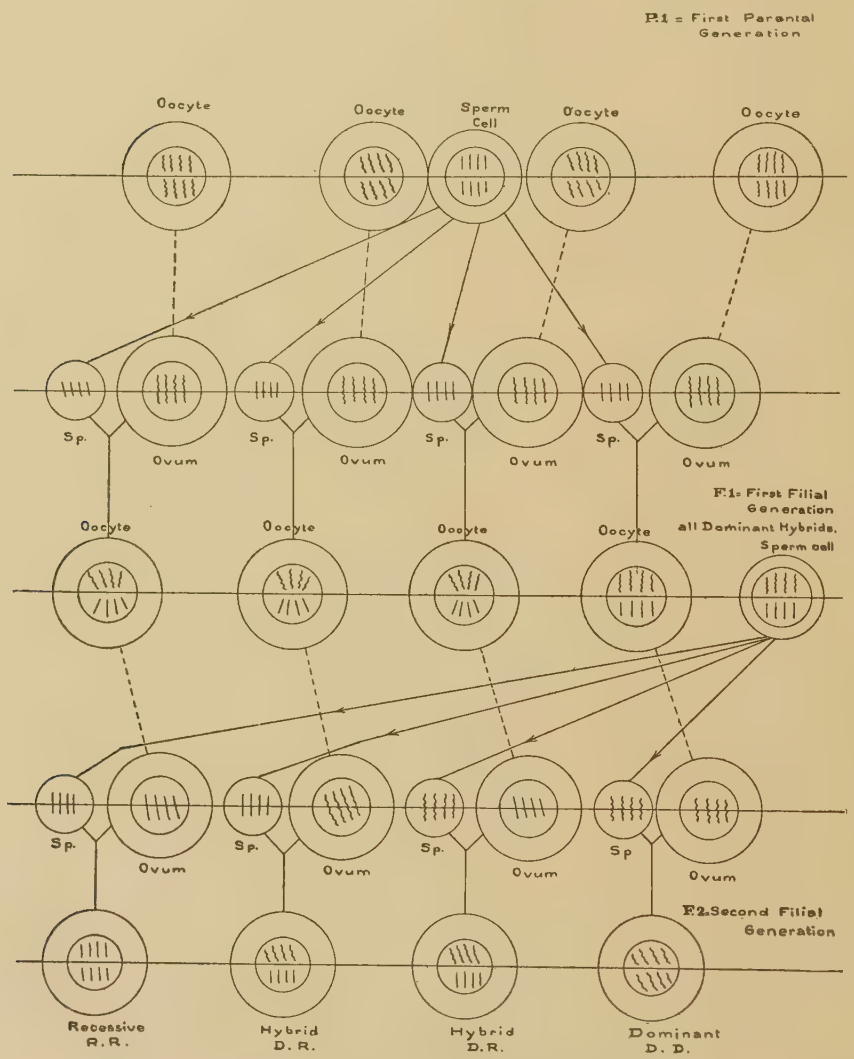


FIG. 5.—A single germ cell after fusion with another may be acted upon by environment, the struggle of parts, use and disuse, physical activity, organic selection, natural selection, isolation, or any other influence, so that after many generations have passed each individual developed from the original germ cell will have become differentiated and specialized. If the influences have been opposite in nature on two groups of individuals in different localities, extreme variations in opposite directions may have taken place. When these variations are crossed, there is an exhibition of Mendel's laws as illustrated in the figure, for a period of time, with inbreeding, but finally there is fusion more or less complete. At some time in the course of fusion there are three types, the two original ones and a blend of the two. The ultimate result may be complete fusion with the formation of a perfect blend.

When each sperm cell or oöcyte of the first filial generation is a hybrid of mother and father, it gives rise to ova or spermatozoa by reduction division with a loss of one-half of its chromosomes, thus becoming like mother or father. Then it unites with a like or unlike cell of the opposite sex (ovum or sperm) and reproduces type according to Mendel's laws. This applies when the cross of two opposite extremes in one character takes place, as when blue eyes and brown eyes (Davenport), long and broad head or long and wide face are crossed (Boas), but not when this is the case with the two opposite extremes of other characters, such as ear length in rabbits. Blending ultimately manifests itself even in the most diverse characters that at first exhibit Mendel's law in all cross-mating. Castle has shown that repeated crossing for many generations alters apparently pure characters, so that black hair becomes contaminated with white and white with black, and although continual crossing has not been carried on further than this, there is reason to believe that ultimately the extremes will produce a perfect blend.

In any cross of extremes the chromosomes or side chains of the germ cells are in unstable equilibrium. In the next generation there is a rearrangement of the chromosomes in all possible combinations, giving a ratio of apparent dominant to recessive, of 3 to 1, 9 to 1, or 27 to 1, with one character, two characters, or three characters respectively. Continual crossing *inter se* enables the side chains or chromosomes to become accustomed to those of the opposite nature by continued union and disunion in the sex cells; the opposite qualities become reconciled, as it were, and blend slightly. This blend becomes more and more perfect and complete as generation succeeds generation.

It is to be supposed that when two distinct types of men come together and intermarry, there will be a conformity to Mendel's laws more or less complete for each character, depending upon the distinctness of the types; then a gradual alteration of each type in the direction of the other takes place until finally, if time and other circumstances permit, there is a perfected blend of the two. This has probably occurred in Australia, Tasmania, and other isolated regions, and is now going on in nearly all parts of the world.

Prehistoric Europe, Asia, and Africa were overrun by hordes of little people now generally known as Iberians, who settled the British Isles, the Atlantic coast and the Mediterranean basin almost to the exclusion of all others. The Iberians were short, slender, delicately molded individuals with coal-black hair and eyes, a tan complexion and a very long, narrow, high head represented to-day by the most characteristic Spanish type. (Pls. I, VI, etc.) This stock was superseded in early historic times by the Celt or Gaul who conquered or peacefully infiltrated the region of central Europe and the British Isles, but did not drive out or exterminate the little dark men of prehistory. The Celt (Pls. II

and V) was about as different from the Iberian as one white man could be from another, being a giant in size and strength, with yellow hair and blue eyes, ruddy complexion, and a large, round head not high, but with beetling brows. The intermingling of these two extreme types of the white race has resulted in the Celt-Iberian (Pls. IV and VI), who is in nearly every measurable feature intermediate between the Celt and Iberian as they originally existed, but with the coal black hair of the Iberian and the blue or gray eyes of the Celt. Hair color and eye color are evidently separate characters, as they have not blended, and may follow Mendel's laws.

When the Celt overspread Europe, and came to England and mingled with the Iberian, the Celt-Iberian, or Blend No. 1, was formed. This formation represents the hybrid. The Iberian and the Celt reappeared in succeeding generations, but in time became more and more alike, until at present the differences are slight, as is shown by the measurements of the two types. The Celt-Iberian has continued and to-day represents the hybrid of the two existing types, the Celt and the Iberian. The Northern and Iberian came together at a later period in the same manner and formed the Blend No. 2 or Northern-Iberian. The Celt and the Northern type must have mingled and some of those included under the Northern type are undoubtedly the hybrid Celtic-Northern. The Iberian is, then, approaching and becoming like two types, the Northern and the Celt, which is apparent from the physical resemblance of the three. The Saxon and the Alpine may be considered as blends of the Celt and Iberian with a preponderance of the Celt, as in the Celt-Iberian there is a preponderance of the Iberian. The Littoral (Pl. VII) and Adriatic are distinct types as much as the Northern, Celt and Iberian, and probably represent the modernized Cro-Magnon and Neanderthal man. They are modified by the three other types, all of which have some of the characteristics of these two primitive ones, some more than others, the Northern partaking largely of the Neanderthal, the Iberian, of the Cro-Magnon. There is a progressive fusion of all the types going on at the present time, with a persistence, more or less pure, in a few individuals of some features of the primitive types. The Northern, Iberian, Littoral, and Blend No. 2, have the height, head length, and tendency to a hypsistenocephalic condition resembling the type of the Cro-Magnon, Laugerie and Chancelède man of the late paleolitic or Magdalenian epoch in Europe, or of the men from the grottoes of Grimaldi; all of these ancient remains being characterized by similar features. The Littoral has preserved more definitely the original composite traits, while the others have blended them with their intrinsic characteristics. The Adriatic and the Northern have the brow ridges, the big bone and muscular development and the shape of the sagittal outline

of the head of the Neanderthal-Spy type. The occurrence of a football-player of the Adriatic type so closely resembling the Neanderthal man, indicates that the Adriatic type may be the nearest living related form to this primitive precursor, the men of Krapina being intermediate between the two. An additional factor favoring this view is the low class standing of the Adriatic type, particularly of the football-player. The Neanderthal skull is dolichocephalic, but Schwalbe has demonstrated that the brain was brachycephalic. The enlargement and development of the brain gives a brachycephalic head as is seen in the Adriatic type.

There is evidence, then, of a persistence of the riverdrift man of interior Europe, represented primarily by the Neanderthal-Spy type, secondarily at a later period by the men of Krapina, and at present by the Adriatic, with some characteristics present in the Northern and possibly in other types; as well as a persistence of the Cave man of Europe and the British Isles (Boyd Dawkins, Eskimo) in the Littoral, and somewhat modified in other types. The Semitic, Iberian and Celt, with their affinities in the types, are derived from other uncertain sources.

When a single individual of any type is considered it should not be supposed that the type is pure, but on the contrary, each individual may have possibilities in the sex cells of any number of types, and the different sex cells have a different arrangement of the chromosomes so that as frequently happens, there may be several types in one family, especially if father and mother are of extremely different types, when the possibilities are greater. This may explain the appearance of Iberian, Alpine, Northern, Littoral and Blend Number 1 in one family of my acquaintance, while in another there appears Celtic, Saxon, Littoral, Alpine and Iberian, in the former the father being Iberian or Northwestern (Littoral) and the mother Northern, and in the latter the mother Iberian and the father Celtic.

Individual characters are inherited in the same manner as these types, when they are specific and separable, as in the case of the black and white hair of guinea pigs, and Mendel's law ultimately works through the law of chance in all heredity.

It is to be noticed that none of the types are pure unless it be the Celt, and even this may have obscure recessive characters. Only by individual records of families followed for at least three generations can the tendencies herein suggested be confirmed. Boas has shown that in crossing long and short heads and wide and narrow faces (among Jews and Indians) there is a tendency toward divergence in the offspring, the more unlike the parents are; and the more nearly alike the parents, the greater the tendency toward a blend of the two. Davenport and Davenport have shown that the eye color follows Mendel's laws, dark

brown being dominant to brown, brown to gray, gray to blue, the later being the pure recessive.

Certain types by reason of their numbers, their derivation and their general distribution may be considered typically American. Such are the Northern, Iberian, Saxon, Celt and Blends Nos. 1, 2, and 5. The Alpine, Vistulian, Littoral, Adriatic and Blends Nos. 3 and 4 are largely of recent foreign extraction. The trend of the American type is in the direction of increasing height, blended coloring and mesocephaly.

SUMMARY.

Physical measurements of 923 boys and 116 girls are presented, with eye color, hair color, and head outlines; and various indices of the head are computed, the brain weight is calculated, and the class standing is given. From these data types are selected representing existing homogenous entities.

Ripley's three European races predominate, Deniker's European races are found somewhat modified, and in addition to these types, five blended types are designated.

A tentative scheme for type heredity is formulated to explain the relation of the types found to the types known to have existed in the past, and to indicate existing tendencies and predict future developments of types in America.

CONCLUSIONS.

Collective evidence favors the conclusion that the prehistoric types of men in Europe have persisted to the present time, and are found in America somewhat modified; other types are found representing later intrusions into Europe; a blending of these types has transformed them and created new ones; and the apparent ultimate result will be a complete fusion of all the types.

Feminine types corresponding to the masculine are nearer in form to the primitive, not having become so differentiated.

All hypotheses and conclusions are tentative, and await other work now pending for confirmation.

My thanks are due to Dr. McMurrich for his great kindness to me during the time I was engaged in making the physical measurements, especially for taking my classes, and only through his generous assistance was I enabled to complete the work.

BIBLIOGRAPHY.

ADAMI, GEORGE J.

Inheritance and Disease: Osler's Modern Medicine. Philadelphia and New York, 1907, 1, 17–51.

BALDWIN, JAMES M.

Psychology. New York, 1906.

BATESON, W.

Mendel's Principles of Heredity, Cambridge, 1902. An Address on Mendelian Heredity and Its Application to Man: *Brain*, Part II, 1906.

BAXTER, J. H.

Statistics: *Med. & Anthrop., Washington* (1875), **1**, 19.

BEAN, ROBERT BENNETT.

A Preliminary Report on the Measurements of about 1,000 students at Ann Arbor, Michigan: *The Anatomical Record* (1907), **1**, No. 3.

BEDDOE, J.

The Races of Britain: Trans. *Brit. Ass. Adv. Sci.* (1857), **188**, 120; *L'Anthropologie*, Paris (1894), 513–529, 658–673; *ibid.* (1903), **14**; *Journ. of Anthrop.* (1870) 117–131; *Journ. Anthrop. Inst.* (1900), **30**, 16–20.

BOAS, FRANZ.

Amer. Anthrop. (1903), **5**, 530–538; *ibid.* (1907), **9**, 453–469.

BISCHOFF.

Das Hirngewicht des Menschen. Bonn, 1880.

BOULE, M., and VERNEAU, R.

Les Grottoes de Grimaldi. (Baoussi-Rousse.) Imprimierie de Monaco, 1906.

BOWDITCH, H. P.

Eighth Ann. Rep. Mass. State B'd Health, 1877.

BROCA, PAUL.

Bull. Soc. d'Anth. de Paris (1864), 303–315; *ibid.* (1873), 247–252, 313–328; *ibid.* (1874), 658–663; *Revue d'Anth.* (1873), 577–628.

BROOKS, W. K.

The Law of Heredity. Baltimore, 1883 (et als.).

CASTLE, W. E.

Science (1903), **18**, 396–406.

COLLIGNON, R.

Bull. Soc. des Sci. de Nancy (1881), 3–21.

DAVENPORT, C. B.

Statistical Methods. New York, 1904.

DAVENPORT, G. C. and C. B.

Heredity of Eye Color in Man: *Science* (1907), **26**, 589.

DAVIS, J. B.

On the Peculiar Crania of the Inhabitants of Certain Groups of Islands in the Western Pacific. Haarlem, 1886.

DENIKER, J.

Les six races composant la population actuelle de l'Europe: *Journ. of Anthrop. Inst. of Great Britain and Ireland* (1904), **34**, 203.

The Races of Man. London and New York, 1901.

DAWKINS, J.

Early Man in Britain. London, 1880.

Fishburg, M.
Materials for the Physical Anthropology of the Eastern European Jews: *Mem. Amer. Anthrop. & Ethn. Soc.* (1905).
Physical Anthropology of the Jews: *Amer. Anthrop.* (1902), **4**, 684–706; *ibid.* (1903), **5**, 89–106; *Arch. f. Anth.* (1890), **19**, 167–182; *Ztschr. f. Demog. u. stat. d. Juden. Berlin* (1905) **1**, 4.
Galton, F.
Natural Inheritance. 1889.
Gorjanovic-Kramberger.
Der Diluviale Mensch. von Krapina und sein Verhaltniss zum Menschen von Neanderthal und Spy: *Biolog. Cntrbl.* (1905), **25**, 805.
Gould, B. A.
Med. Statistics Prov. Marsh. Off. War Dep't, Washington, 1869.
Haveloque, A. A.
Bull. Soc. d'Anth. Paris (1874), 705–715.
Hoernes, M.
Der Diluviale Mensch in Europe. 1903, 40–227.
Horton-Smith, R. J.
Journ. Anth. Inst. (1896), **26**, 82–102.
Houzé.
Bull. Soc. d'Anth. Bruxelles (1883), **2**, 80–90.
Ihering, R. von.
The Evolution of the Aryan. London, 1897.
Keane, A. H.
Ethnology. Cambridge, 1901.
Man, Past and Present. Cambridge, 1900, 532.
Lamarck, J. B. P. A. de M.
Philosophie Zoölogique. Paris, 1830.
Lapouge, G. V. de.
Rev. d'Anth. (1889), 4, 181–193.
Marchand.
Ueber das Hirngewicht des Menschen: *Abhandlungen der mathematische-physischen Classe der Köngl. Sächischen Gesellschaft der Wissenschaften.* Leipzig (1902), **27**.
Mendel, G.
Versuche über Pflanzen-Hybriden: *Verhandlungen des Naturforchen-Vereins. Brünn* (1866), 4, 47.
Morgan, T. H.
Pop. Sci. Month. (1905), **67**, 54–65.
Osborne, H.
Science, 1900–1907.
Peacock, F. B.
Tables of the weights of the Brain, etc. London, 1861.
Pearson.
Grammar of Science, London, 1900–08; *Proc. Roy. London* (1894–1902), **57–70**; *Biometrika,* 1902–07.
Penka, C.
Origines Ariacae. Wien, 1883.
Pösche, T.
Die Arier. Jena, 1878.
Reid, J.
Tables of the Weights of Some of the Most Important Organs, etc.: *Month. Journ. Med. Sci.* (1843), **3**.

Reitzius, A. A.
Ueber das Gehirngewicht der Schweden: *Biologische Untersuchungen* (1899–1903), **8, 9, 10, 11.**
Ripley, W. Z.
The Races of Europe. New York, 1899.
Schwalbe, G. A.
Mitt. Philomathischen Gesell. in Elsass Lothringen (1897) **5,** 72–85.
Pithecanthropus Erectus: *Ztschr. f. Morph. u. Anthrop.* (1899), **1,** 16.
Sergi, G.
The Mediterranean Race. Cambridge, 1904.
Spillman, N. J.
An Interpretation of Elementary Species: *Science,* N. S. (1908), **27,** 896.
Taylor, I.
The Origin of the Aryans. London, 1890,
Topinard, P.
Eléménts d'Anthropologie Général. Paris, 1885.
Weissmann, August.
The Evolution Theory. London, 1904.
Woodruff, C. E.
The Effect of Tropical Light on White Men. N. J., 1905.

ILLUSTRATIONS.

PLATE I. Iberian type (original); Spaniard from Madrid (photographs by Martin).
II. Celt (Kelt of Britain) type; from North Carolina (photographs by Martin).
III. Littoral type (modified); Indian Sikh from the Himalaya Mountains (photographs by Martin).
IV. Celt-Iberian type; from Wisconsin (photographs by Martin).
V. Celt and Iberian types (photographs by Martin).
VI. Celt-Iberian and Iberian types (photographs by Martin).
VII. Iberian from Madrid, Spain, and modified Littoral from the Himalaya Mounutains (northern India) (photographs by Martin).

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Photos by Martin, Bureau of Science.

PLATE 1.

Photos by Martin, Bureau of Science.

PLATE II.

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PLATE III.

Photos by Martin, Bureau of Science.

PLATE IV.

Photos by Martin, Bureau of Science.

PLATE V.

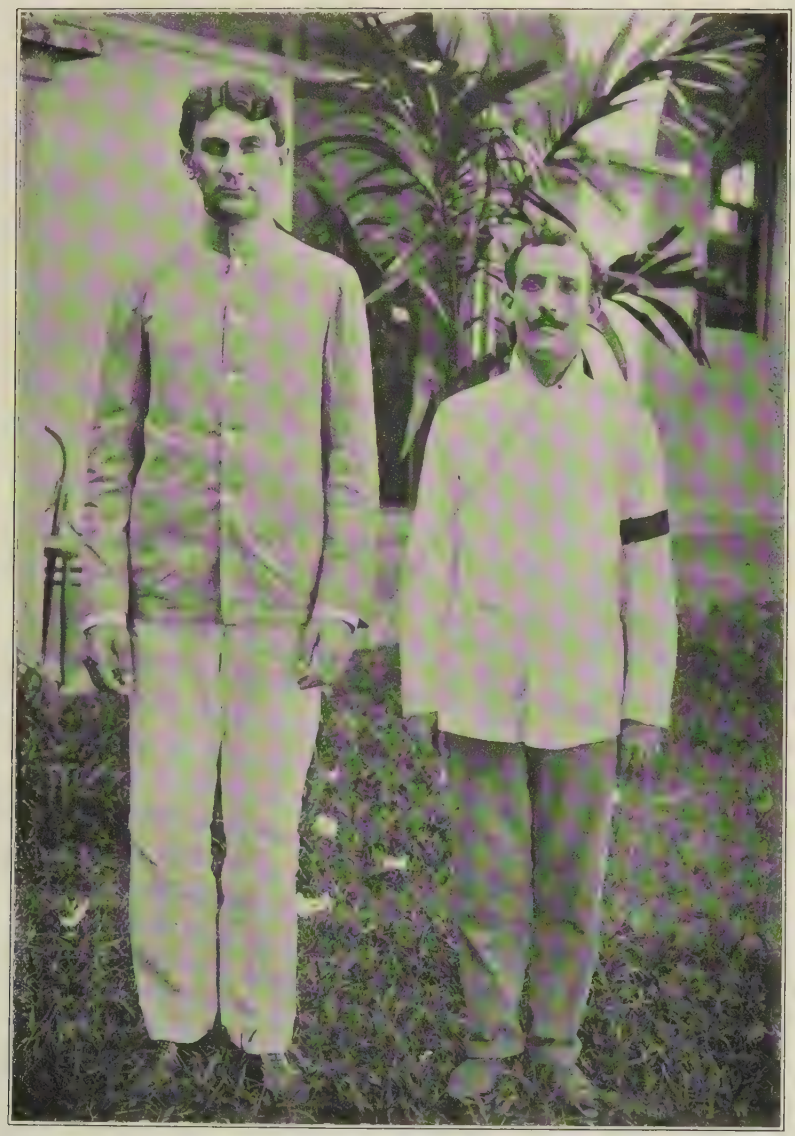

Photo by Martin, Bureau of Science.

PLATE VI.

PLATE VII.

BIOLOGY OF PHILIPPINE CULICIDÆ.

By Charles S. Banks.

(From the Entomological Section of the Biological Laboratory, Bureau of Science.)

Although nearly a hundred species of mosquitoes are now recorded from the Philippine Islands and new ones are constantly being discovered in every region where collecting is done, very little has been known heretofore of the habits and life histories of even the most abundant species, among which may be mentioned *Myzomyia ludlowii* Theob., *Stegomyia persistans* Banks, *Culex fatigans* Wied., and *Culex microannulatus* Theob.

While many species are perennial, others are abundant only at certain times of the year. Of those breeding in or near dwellings some are day flyers while others are to be encountered only after dark, being most prevalent before midnight.

There are few people who, after a year or two of residence in this region, are not able to recognize some of these pests either because of their form and coloring, or from their habits.

Worcesteria grata Banks.

Worcesteria grata Banks, *This Journal* (1906) **1**, 780, 982.

Egg: The egg is 0.67 to 0.70 millimeter long and 0.43 to 0.47 millimeter in diameter, of a very broad, blunt, regular ellipsoidal shape. (Pl. I, fig. 1.) It is pure white when laid, but turns to a dirty pinkish-gray previous to the hatching of the larva. The surface appears granular when seen with a low-power lens (Pl. I, fig. 1 (*a*)), but when placed under a high power, small, sub-ovoidal tubercles are seen. Some of these appear spherical with a spinous projection. These tubercles vary greatly in size (Pl. 1, fig. 1 (*b*)), and their surfaces are coated with a filamentous, powder-like substance, impervious to water. The egg is thereby made to float perfectly upon the water, no part of it being submerged at any time. The largest tubercles measure 0.014 millimeter by 0.01 millimeter (Pl. I, fig. 1 (*c*)), while the smallest are about 1 μ.

When the larva is about to hatch, the egg shell splits irregularly around the short circumference in such a way as to leave the ends joined together by a narrow strip. (Pl. I, fig. 1(*d*).) The eggs are laid in the hollow stumps of bamboo in water which contains other mosquito larvæ. They are deposited during the late afternoon or early evening. Mosquitoes in captivity lay about 20 or 25 eggs each day during a period of two days. As many as 10 larvæ of the same size have been found in

a single joint of a bamboo fence, so that it is probable that in nature the female lays more eggs than when in captivity.

Larva: The larva upon hatching measures 2 millimeters in length, and is nearly pure white; when full grown its length is 14 millimeters. The general form and appearance of the larva upon hatching is the same as it is when full grown, except in color. The distinctive appearance of the head and the lateral bristles and spines remains the same throughout the larval existence.

Full-grown larva: The full-grown larva of *Worcesteria grata* Banks measures 14 millimeters in length, exclusive of caudal bristles, and 2.5 millimeters in width, exclusive of lateral bristles. The color is carmine on the dorsal surface and pink or whitish-pink ventrally. The head is dark brown, the eyes being nearly black. (Pl. I, fig. 2.)

The surface of the body is covered at certain points by dark brown, chitinous plates or sclerites, from which the bristles and setæ grow. These sclerites are regularly and definitely arranged as shown by the figure.

The head, which is slightly more than half the length of the thorax and a little more than half its width, is subquadrate in general outline, the anterior portion being somewhat more acute than the posterior, the outer angles of which are rounded.

The eyes are situated about half way from the front under a lateral, longitudinal carina. The antennæ are less than half the length of the head, have three sub-apical bristles on the inner margin and a single apical one. A bristle projects on each side of the face near the median line. Three project laterally beneath each eye.

The arrangement of the thoracic bristles is somewhat the same as in *Myzomyia ludlowii* Theob. There are two distinct types of bristles upon the thorax. Those growing from the chitinous sclerites are setose or plumose, while those from the other portions are simple, as shown in the figure.

The setæ or hairs found upon the body segments are so arranged and of such length proportionately that when spread out laterally, which is their normal position, they make the gross outline of the larva an acute oval or lens shape.

The ninth segment and breathing siphon are of a structure meriting special note. The entire segment is covered with a brown, chitinous sclerite, the posterior, lateral and ventral edges of which are minutely serrate or dentate. A single plumose seta projects from the posterior lateral margin, and below this seta and projecting posteriad to it is a series of long, fine, simple hairs.

From the posterior portion of the dorsal margin of the segment projects a small, fleshy tubercle from which there grows a cluster of long, simple hairs, ten in number. This tubercle serves as an anchor when the larva rests against the side of the vessel in which it breeds.

The anal papillæ, which I shall term anal tracheal gills and which, undoubtedly, serve as a secondary respiratory apparatus, are very short and evenly rounded, scarcely projecting beyond the posterior margin of the ninth segment.

The respiratory siphon is short and stout, the length being only slightly more than twice the width of the base. The entire surface of the siphon, with the exception of the articulation at the base, is covered by a single chitinous sclerite. From a small, soft tubercle at the posterior edge of the base, fine, short, stout pectinate bristles project. These bristles are not as long as the diameter of the base.

Ventrad to the base of the siphon, on each side of the eighth segment, is a single, subtriangular, chitinous sclerite, from the posterior edge of which project caudad two pectinate bristles, one from the middle and one from the ventral angle. (Pl. I, fig. 3.)

The larva of *Worcesteria grata* Banks is purely carnivorous, but I have never noted an instance in which it was cannibalistic. Three larvæ, nearly full grown, were placed in a 2-liter glass jar for two days without food, and during that time none of them attacked the others, although as soon as larvæ of *Desvoidya joloensis* Ludlow were put in, they were attacked by the *Worcesteria* larvæ.

The number of larvæ of different kinds devoured by one of *Worcesteria grata* Banks during its period of growth is quite astonishing. The record for three larvæ is given herewith:

Fifty eggs laid July 12, 1906. Larvæ hatched July 16, and all died except four. About four hundred larvæ of *Culex fatigans* Wied., which hatched the same day, were fed to the *Worcesteria* larvæ on July 16, in addition to three half-grown *Culex* larvæ already in the jar.

Five half-grown larvæ of *Stegomyia persistans* Banks were fed to them on July 17, and ten full-grown larvæ of the same species during the afternoon of July 17. The first molt of the *Worcesteria* larvæ occurred during the night of July 17, and during the day of July 18 they almost doubled in size. On the 18th day of July, in the night, one larva died from an unknown cause.

Twenty-five full-grown *Stegomyia* larvæ were fed on July 18. The second molt occurred during the night of July 19. On July 20, twenty full-grown *Stegomyia* larvæ were fed. The third molt occurred at noon of July 21. Fifteen full-grown *Culex fatigans* Wied. larvæ were fed on July 22 and fifteen more on July 24. On July 24 the *Worcesteria* larvæ appeared to be about full-grown. On this date four full-grown *Stegomyia* larvæ were fed, and twenty more were given on July 25. One larva pupated on July 26 during the early morning, and another later on the same day. The remaining larvæ ate nine *Stegomyia* larvæ and pupated at 5 p. m. on July 29.

Two adults emerged during the early morning of August 1, and the remaining adult on August 3. These were all females, and were from eggs which were laid by a single female which emerged in Iloilo on July 6 in company with a number of males taken from material which I had brought from Mailum in the town of Bago, Negros Occidental.

During my stay in Negros, I was unable to obtain eggs of this species for rearing. However, the larvæ were captured in considerable numbers and the following notes as to their growth are given herewith:

May 26: A nearly full-grown larva captured. This was the first of this species and was taken in a bamboo joint associated with numbers of *Desvoidya joloensis* Ludl., but on June 7 it died.

June 7: Four nearly full-grown larvæ taken, each from a different bamboo joint. The water in these cups was perfectly clear and clean and contained larvæ of *Stegomyia samarensis* Ludl.

June 12: One larva pupated.

June 14: A second larva pupated.

June 17, 7.30 p. m.: The pupa from the larva of June 12 changed to an adult female.

June 19, 11.40 a. m.: An adult emerged from the pupa of June 14.

June 20: Eight larvæ were found in the liquid in the top of a bamboo ladder at the front door of a native's house. There were numerous other larvæ of *Culex* sp. and maggots of some other unidentified dipteron. The liquid was composed of rain water and urine voided into the receptacle by the children of the house,

they having scooped out the larvæ and brought them a half mile to the house where I was working, as I had promised a reward of 1 centavo ($0.005) for each larva captured.

June 21: Ten larvæ were taken from a large bamboo fence post, and two from each of two other posts.

June 24: The larvæ began pupating.

June 28: The receptacle was transported 18 miles to the coast where I was to embark.

June 29: Adults began emerging.

July 1: All larvæ had transformed to pupæ.

July 6: The last adults emerged in Iloilo.

The total number of adults was twenty-four and of this number five were saved for breeding, including two females and three males. The remainder, some of which had been slightly damaged, were killed and pinned.

July 6: The insects copulated, the females hanging from the gauze cover of the jar and the males clinging to the ventral part of the females' bodies. These insects were fed upon bananas which they relished greatly, refusing all other kinds of food, including sirups which they seemed to shun.

July 7: One female died.

July 8: One male died.

July 10: The three remaining insects, two males and one female, were placed in a large glass jar containing a bamboo joint half full of water.

July 11: The two remaining males died.

July 12: The female began laying eggs, continuing until July 13, the total number being about fifty.

July 14: The eggs began hatching and continued to do so until July 15.

Many of the larvæ died from lack of food and only four were saved, as was stated above.

July 14: The female died and sank to the bottom of the bamboo joint where she was found on the morning of July 15.

The life of these four larvæ has been given above.

HABITS OF THE LARVÆ.

The larvæ of *W. grata* Banks remain in almost a horizontal position upon the surface of the water, only going below when pursuing their prey or when disturbed. When chasing other mosquito larvæ, they move directly forward by a snake-like wriggling which is very slow and stealthy. When they have approached within reaching distance, they make a quick forward dart and seldom fail to capture their prey. They frequently take other larvæ which have just come to the surface, by simply twisting the body and making a straight lunge for the unsuspecting victim; once they have caught a larva, they begin eating and do not pause until they have consumed the entire carcass. Sometimes they begin at the head or in the middle, but most frequently they eat from the tail and forward while the captive still moves. When at rest in a bamboo joint, they remain anchored to the sides by the caudal setæ, their heads pointing toward the center.

Larvæ, when living under conditions in which they can obtain an abundance of food, eat such large quantities that they grow very fat, and some

of them, just before the period of pupation, appear as if about to burst from the accumulation of adipose material.

Pupa: The pupa is light brown. It measures 14 millimeters in length over the dorsum, and 4 millimeters across the thorax.

Two small, submedian bristles project cephalad from each side of the dorsal metathoracic segment. Posterior to these, on each side of the dorsum of the first abdominal segment projects a tuft of fine plumose bristles.

Each of the remaining abdominal segments, except the seventh and eighth, bears on its posterior dorso-lateral margin a long bristle or in some instances two. The seventh segment bears a spine-like bristle and four others, all growing from the same point.

The pinnuræ are large, nearly circular, and with a fine fringe along the outer margin from the vein to near the base. They are devoid of urochaetæ.

The respiratory siphons are large, but not disproportionate. Their bases are only slightly smaller than the apices, which latter have a sub-oval respiratory opening. (Pl. I, fig. 4.)

The pupa usually remains quietly at the surface, but upon the slightest provocation swims rapidly to the bottom, except when about to transform. This operation generally takes place in the late afternoon.

HABITS OF THE ADULT.[1]

Several notes have been published with regard to the habits of this group of mosquitoes. All agree that the members are sylvan in habitat, but observers differ as to their being harmless to man and animals.

Theobald says:[2]

"It is erroneously supposed that they are not annoying to man and animals; several occasion severe irritation from their bites. Captain James, I. M. S., sends me the description of one (*Megarhinus immisericors* Wlk.) which is very troublesome in India." He says further, in speaking of *M. separatus* Arrib.: "They are called 'carapana' in Brazil and bite very badly in the daytime and at night."[3]

Having had the good fortune to be able to rear large numbers of this interesting mosquito, and having read that the members of this group are considered to be voracious bloodsuckers, I determined to experiment in order to discover whether this species has such propensities. Two things prompted me to the conclusion that it does not suck blood—first, it is a purely sylvan species; and second, the gross appearance and manner of manipulating the proboscis would seem to point toward non-bloodsucking habits.

All the mosquitoes, both males and females were given an opportunity to bite, being placed upon my bare arm, and upon those of Filipinos and others; but aside from walking over the surface and touching it occasionally with the palpi and tip of the proboscis, they made no attempt which could be interpreted as aggressive.

[1] For description of the adult see *This Journal* (1906), **1**, 779.
[2] *Mono. Culic.* (1901), **1**, 217.
[3] *Idem* (1903), **3**, 114.

They fed freely upon soft banana and pineapple and a female was observed drinking water from the vessel in which she was confined, but they would not sip either plain or fruit syrups.

As these experiments were tried at all hours of the day and in the evening, they would seem to be fairly conclusive proof of the innocence of this mosquito in regard to a habit of sucking blood.

I have dissected the probosces of both male and female specimens and while each shows a development of the labrum-epipharynx which might suit it for piercing, the apices of the mandibles and maxillæ are not serrated, but are soft and thin and in no way adapted to piercing; while the dorsal suture of the tube-like labium is so constructed as practically to prohibit its separation, as in the case with biting mosquitoes when the piercing organs have been inserted into the skin of the victim. In other words, the labium is better adapted to sucking juices which lie upon the surface, while the sharpening of the labrum-epipharynx is merely a morphological relic.

The few specimens of this species which have been captured as adults were invariably taken during the late afternoon, so that *W. grata* Banks could not in all probability be classified as a day mosquito.

As the larvæ of this species destroy enormous numbers of those of other mosquitoes, experiments looking toward their propagation would be valuable. Their introduction into tanks and other receptacles where mosquitoes breed, especially in gardens and dense coppices, might tend to their greater abundance near dwellings; and even if they were to attempt to attack man, their great size would render them sufficiently conspicuous as to allow of their being easily driven off. However, I am thoroughly convinced that the latter contingency would never arise. (See Pls. II and III for male and female adults.)

DESVOIDYA JOLOENSIS Ludlow.

Desvoidea fusca joloensis Ludlow, *Can. Ent.* (1904), **36**, 236.
Desvoidya ———————— Banks, *This Journal* (1906), **1**, 983.
———————— joloensis Theob., *Mono. Culic.* (1907), **4**, 163, 165.

This mosquito was found to be abundant during the months of April, May and June, in upland villages surrounded by woods and bamboo thickets. It has also been taken in Manila.

Egg: The egg of this species is quite similar in general appearance to that of *Stegomyia persistans* Banks, except that it is about one-ninth to one-eighth longer and the sides are more nearly parallel. The ends are more obtusely rounded. The sculpture of the air cells is nearly the same, except that the hexagonal figures are not elongated transversely. It is 0.84 millimeter in length. (Pl. IV, fig. 1.)

OVIPOSITION.

A female of *Desvoidya joloensis* Ludl. was observed flying around the open bamboo cups of water upon the table in my temporary laboratory at Mailum. The female entered one of these and was seen to crawl down the side of the vessel backwards. When near the surface of the water,

i. e., on the moist zone of the cup, she curved the abdomen downward and immediately deposited a cream-white egg. This operation was continued until four or five eggs had been laid. She then flew to the opposite side of the cup, crawling around and palpating the moist surface with the tip of the abdomen until another spot to her liking was found, whereupon she deposited several more eggs. A piece of gauze was placed over the cup and the mosquito continued her egg laying. The next day, as she had apparently laid all her eggs, she was killed and pinned.

The eggs hatched two days later.

Larva: The full-grown larva is 10 to 12 millimeters long. (Pl. IV, fig. 2.) It is either pure white, or as is more common, of a pinkish hue, especially over the dorsal areas of the abdominal segments and the thorax. Occasionally, a very dark specimen will have fainter indications of the same color on the ventrum.

The head is very broadly oval, nearly circular in outline. The frontal area has four transverse simple setæ, the two nearest the median line being two-thirds the length of the outer ones. A bifid seta projects laterad from below each eye-spot and another of the same kind, four times as long, projects caudad from the posterior inner angle of the eye-spot itself. The terminal (second) segment of the antennæ is very minute, being less than one-fourth the diameter of the first.

The posterior pseudopoda are the best defined, being very large and projecting from the posterior lateral angle of the thorax. The mid and anterior tubercles are well defined, but not prolonged into pseudopoda.

Each tubercle bears finely pectinate setæ.

The abdominal segments bear single, simple setæ on their lateral margins, and on the posterior dorso-lateral area, a single bifid seta. In addition to these there are on the first, second, third, fifth, sixth, and seventh very minute, lateral bifid setæ, hardly perceptible. Otherwise the larva is quite bare of setæ.

The respiratory siphon, which is chitinous for three-fourths its length from the tip and devoid of pecten scales, is twice the length of the eighth segment, from the longitudinal axis of which its axis is deflected only slightly.

The ninth segment is very short and bears a dorsal setiferous, chitinous sclerite, subtriangular in general outline, and with crenulate margins. The dorsal anchor bristles are short and pectinate, about ten in number; the ventral twice as long and of similar structure, being composed of eighteen setæ.

The anal tracheal gills are very robust, ellipsoidal, white, mottled regularly with gray annulations and are one-half longer than the respiratory siphon.

The lateral comb is composed of eight blunt, irregularly placed scales. (Pl. IV, fig. 3.)

The length of the larval stage is about five days.

HABITS OF THE LARVÆ.

These are the most sluggish culicid larvæ that I have ever seen. They move slowly and with a forward, wriggling motion, remaining for long periods beneath the surface, and usually feeding among the chips of bamboo to be found in the cups after the tree has been cut down; or in the case of fence posts, where the top has been trimmed. They fall an easy prey to the larvæ of *Worcesteria grata* Banks, which are nearly always found where the *Desvoidya* larvæ breed.

The very large size of the anal tracheal gills provides for subaquatic respiration, and the insect finds its food in the bottom of its breeding

receptacle, so that it need not come frequently to the surface. As the *Worcesteria* larva seldom goes below the surface region, it must catch the *Desvoidya* larva when it rises, and this act it performs very skilfully, quickly darting its head around in an arc of a circle, using its respiratory siphon as a pivot or center. The *Desvoidya* larva once captured, makes very few struggles, as if realizing that it is helpless against its stronger foe.

The larvæ of this species are always very fat in the latter period of their growth, and from this fact I strongly suspect them to be cannibalistic, the larger preying upon the smaller, although I have never had ocular demonstration of this. One seldom or never finds larvæ of assorted sizes in the same receptacle and this would be somewhat of a proof that the smaller are not allowed to live with their larger fellows.

It might be suggested that the equality of size in these larvæ could be explained by the fact that all the eggs are laid at a given time, but the adults have been seen depositing their eggs on different days in the same cup.

Pupa: Length over the dorsum, 8 millimeters; of a rather light brown until a day or so before the adult emerges, when it turns black and white, the adult colors showing through the pupal skin.

Both the first and second abdominal segments bear a pair of dorsal plumose setæ, those on the first being very much larger than the other pair.

The respiratory siphons are cornucopia-shaped, the anterior portion of the lip being truncate.

The pinnuræ are irregularly oval, being broadest at the distal extremity, and retuse at the point where the vein meets the margin. The cilia are quite long and extend around the entire distal portion from the middle of each lateral margin. The surface is finely reticulate and slightly pilose.

The urochætæ are one-fifth the length of the pinnuræ and are straight except at their bases, where they are sharply curved. (Pl. IV, fig. 4.)

The seventh abdominal segment bears at its posterior lateral angle a 4-parted pectinate spine, while the eighth has a similar longer one of ten branches.

The pupæ are very lethargic in their movements, remaining grouped together at one side of the containing vessel. The pupal stage lasts for three to four days.

Adult: The adult specimens reared by me conform in every respect to the description given by Ludlow.[4]

These insects fly in a very leisurely manner and with the hind legs curved upward over the back, the fore and mid legs spread out considerably from the body on each side and the tarsi recurved. The note made by their wings is very low, due to the slow vibration.

In the early morning, about daybreak, and in the early evening, they

[4] *Can. Ent.* (1904), **36**, 236.

are always abundant in regions near forests. They are vicious biters and inflict a very painful sting, which lasts several hours. They occasionally enter houses.

STEGOMYIA PERSISTANS Banks.

Stegomyia fasciata persistans Banks, *Philip. Journ. Sci.* (1906), 1, 984, 996.

Egg: The egg of this species measures 0.75 millimeter in length. It is a long, slender oval, slightly blunt at one extremity. It is a light gray when laid, but within a very short time turns jet-black. The surface is very finely reticulated.

The eggs are laid singly at the water line upon the sides of vessels in and around houses, most frequently in receptacles containing rain water.

The period of incubation is twenty-four to forty-eight hours according to the temperature.

Larva: The larva upon emerging measures 1.2 millimeters and is light gray, with the exception of the head which is brown-gray.

The larval period lasts seven to ten days, during which the greatest growth is made in the first five days.

The full-grown larva measures 10 millimeters in length and is most readily distinguished by the color of the respiratory siphon, which is dark chestnut-brown.

The body segments, including those of the thorax, are very pale and semi-transparent. They are sparsely clad with setæ, the three lateral groups on each side of the thorax consisting of from eight to sixteen setæ each. The pseudopoda on the latero-ventral area are well defined, the ungues of the middle and posterior pair being prehensile, while the anterior pair have none. Small chitinous sclerites mark the position of the mid and posterior dorso-lateral pairs of setæ.

Quadrifid bristles grow from the dorso-lateral area of the first three abdominal segments and dorsal to these are very short trifid setæ.

The remaining abdominal segments have long, lateral, trifid or simple bristles and simple to quadrifid setæ of very small size on their posterior areas.

The lateral comb of the eighth segment consists of ten comb scales, dorsad, ventrad, and caudad of which on each side is a quadrifid seta. The pecten scales are fourteen in number with a quadrifid bristle on the air tube at their apical limit.

The lateral comb of the eighth segment consists of ten scales, dorsad and ventrad to which on each side is a quadrifid seta; posterior to the middle of the comb on the margin of the segment is a long quinquiefid, pectinate bristle.

The general appearance of the ninth segment is like that of *Worcesteria grata* Banks, the chitinous sclerite covering nearly the whole segment. From the posterior dorsal margin grow the dorsal anchor bristles to the number of six. These are twice the length of the anal tracheal gills ("anal fins" of Theobald) which, in turn are twice as long as the ninth segment.

The larvæ of this species may be distinguished from those of *Stegomyia samarensis* Ludl., by the latter having the surface of the anal tracheal gills covered with minute, regularly placed annular spots. In *S. persistans* Banks, the tracheæ in these gills are 4- or 5-branched.

Ventrad to the tracheal gills, on the posterior margin of the ninth segment, are the twelve ventral anchor bristles of the same length as the dorsal, but less curved than they.

The respiratory siphon is slightly less than twice as long as the diameter of its base. It is naked except for the pecten scales, a quadrifid bristle before mentioned, and six minute setæ at the apical extremity around the tracheal opening. The surface is finely, transversely reticulate or striate.

HABITS OF THE LARVÆ.

The larvæ may be found in all kinds of receptacles where water collects in and around houses. They much prefer rain water and might almost be called an exclusively rainy-season species, being very much more abundant at that time than during the months from December to May.

The full-grown larvæ feed almost exclusively at the bottom, coming to the surface occasionally to breathe and always to molt. In the latter case, unless disturbed, they remain motionless for several hours previous to shedding their skins.

Whenever an object comes near, or the vessel is jarred, all larvæ go to the bottom where they may remain for several minutes. This feature has a great bearing upon their propagation. As the water in most vessels where they breed is dipped from above, instead of being drawn off from a tap at the bottom, the mosquito larvæ are seldom dipped up because they dive quickly when the surface is disturbed. Even in a pitcher in daily use and in which the water is renewed when low, they may successfully complete their life period. Several cases of this kind have come to my notice, the persons interested asserting that the water in the pitcher or other vessel had been renewed daily, but never taking notice of the fact that the small quantity which always was allowed to remain in the pitcher contained the larvæ.

These larvæ have never been observed feeding upon one another nor upon the larvæ of *Culex fatigans* Wied., with which they are often associated. They feed largely upon the sediment contained in the dregs, which may be both animal and vegetable in its character, but more frequently vegetable, as it is composed of the bits of decaying *nipa* forming the roofs from which the rain water is collected.

The larvæ, in feeding, move forward over the bottom of the vessel, taking in the particles of food with great rapidity and rejecting tiny morsels of undesirable material in a constant stream.

The larval period lasts from five to eight days.

Pupa: The pupa measures 6.5 millimeters over the dorsum. It is gray when newly transformed, but soon turns to an almost black-brown, the markings of the adult showing plainly after the second day. The pinnuræ are thickly clothed with fine hairs, their entire margins being likewise so adorned. The urochaetæ are perfectly straight and are one-fourth the length of the pinnuræ. A single, very large, simple bristle projects from the postero-lateral angle of the eighth segment, while a few others are found on the posterior dorsal and ventral areas of the remaining abdominal segments.

The first abdominal segment is ornamented dorsally by a peculiar, compound, submedian bristle. This bristle, simple and stout at its point of origin, divides into eight or nine branches, each of which in turn divides into as many more, the last being pectinate, so that the appearance under the microscope is that of a regularly branching tree. Anterior to each of these peculiar bristles, are two other simple ones.

The respiratory siphons have no especial mark for characterization. Their bases are dark brown, their apices pale ochraceous.

The pupal stage lasts for three to four days.

The adult male and female are shown on Plates V and VI, respectively.

Adult: The adult insect has already been described.[5]

HABITS OF THE ADULT.

It would be difficult to imagine a mosquito, or any other insect, which could be more of a strategist than this one. It is altogether a day flier, individuals being seen after dark only on the very rarest occasions. They are extremely fond of dark objects as a place of rest and when found upon light-colored ones they are always on the shadow side.

Persons wearing black stockings are sure to be annoyed very greatly if they sit quietly in one place for any length of time. These mosquitoes bite upon the back of the hands and fingers when the individual's back is turned to the window and a book is held in position for reading. The insects are so wary that they are killed only with the greatest difficulty. After gorging themselves with blood, they fly, rather sluggishly, but directly, to a dark corner, where they will sit upon the wall or other object during the remainder of the day or night.

The bite of this mosquito is always irritating, whether it is left to finish its meal and quietly withdraw its proboscis, or whether it is killed or frightened away before it has finished. A vigorous rubbing of the affected spot will quickly cause a diffusion of the injected irritant and a rapid cessation of the itching, as I have proved by observations upon myself; but for several days afterwards, if the spot is accidentally scratched or lightly contused, the actual point of insertion of the proboscis will again begin to itch. Usually, a tiny, red, subcutaneous point is all that is visible, but occasionally there is slight œdema. The bites of this mosquito cause the most irritation when they occur upon the knuckles of the fingers, a favorite place of attack.

A female of this species will continue her attacks for an hour if she is continually driven off, the insect generally flying up and behind the victim and returning at the side and under the arm of the chair in which he may be sitting. Only a few minutes at rest are necessary before these sly pests take the opportunity of biting, and the killing of one appears to

[5] *This Journal*, (1906), 1, 996.

bring others, or at least they continue to come, one by one, for half an hour or longer.

This mosquito does not bite immediately when it alights upon the hand; rather, she stands as if waiting to see if she will be molested, and, if not, she probes for a moment with the tip of the proboscis and then at once inserts it.

The males have the peculiar habit of flying back and forth in front of anything upon which they are about to alight. This they continue for some time, remaining at a distance of not more than five centimeters from the object.

Copulation: The members of this species copulate in the afternoon between the hours of five and six. A male dancing along in the air in front of an object upon which a female is resting, will, after a few passes, fly against her. She at once takes wing, and the male, pursuing and flying beneath her, clasps her with his fore and mid feet. The two insects fly in this way for about five seconds, performing the act of coition and immediately separating. I have killed many couples by crushing them between the palms of the hand and have invariably found them with the ventral surfaces toward each other. Specimens confined in small jars have been seen to copulate while the female hangs from the gauze covering the vessel, the male always approaching her from the ventral surface.

A single male will copulate with from seven to eight females if confined in a jar with them. After copulation, the males, as well as the females, rest upon a vertical surface upon their fore and mid legs, keeping their hind legs in a constant motion above the back. One leg is usually elevated much above the other.

The females have never been found feeding on anything other than blood. The males are occasionally attracted to sweets, but have never been seen to bite.

STEGOMYIA SAMARENSIS Ludlow.

This species is both sylvan and domestic and while not by any means as abundant in dwellings as *S. persistans* Banks, it is a veritable pest in the forest during the entire day, but more particularly in the late afternoon.

It may be distinguished at once from *S. persistans* Banks by the white, median, dorsal stripe on the thorax. It is, as a rule, a slightly larger species and is not so active as *S. persistans*.

Egg: Length 0.75 millimeter. The egg of this species is practically identical in shape and size with that of *S. persistans*, the only difference being that it is slightly broader across the blunt end. The eggs are laid in the woods, in hollow bamboo joints and are placed upon the soft, wet substance of the joint just above the water. The length of the incubation period is one and one-half to two days.

OVIPOSITION.

A female of *S. samarensis* Ludl. was observed at 11.30 in the morning walking around inside a bamboo cup half full of water and hung in a betel-nut grove. Upon closer observation she was seen to be in the act of egg-laying, the process being as follows: The abdomen is depressed or recurved until the tip comes in contact with the surface of the vessel, the insect walking around in this position until the abdominal cerci touch the moist surface. She stops and immediately deposits a single egg in the slime just above the water. This operation is repeated at intervals of about half a minute, but she may stop for two or three minutes after having laid ten or twelve eggs. In this case she rests, head up, upon the fore and mid legs, the hind legs being kept in motion. The female, during egg-laying, always assumes a position in which the head is farther from the water than the posterior extremity of the body.

The eggs are pure white when laid, but in less than an hour change to a dark, bronzy-brown. The surface is covered with irregular, elongated hexagonal air cells. (Pl. VII, fig. 1.) The eggs are evidently cemented to the slime, because it is not possible to remove them without the adhesion of a small piece of the slime or plant fiber.

Larva: Length 9 to 10 millimeters. (Pl. VII, fig. 2.) The larvæ of *S. samarensis* Ludl. differ when full grown from those of *S. persistans* Banks in being clothed with a greater number of quadrifid setæ upon the abdominal segments, and by the presence upon the surface of the anal tracheal gills of a regularly arranged series of very minute, annular spots. This is found in the full grown larvæ of the species and is the surest means of differentiation.

The pecten scales are twelve to fourteen on each side, while those of the lateral comb of the eighth segment vary in the same specimen, there being eight on one side and ten on the other in several specimens examined. The lesser number has been found always on the right side. (Pl. VII, fig. 3.)

The time required from the egg to the pupa is five to seven days, although larvæ kept without food have lived 15 days.

Pupa: The pupa of this species differs from that of the preceding in the following particulars: The secondary branches of the compound setæ of the first abdominal segment are much longer, the pinnuræ have longer fringes and their surfaces are not covered with pubescence; they are also longer and narrower and their apices are subacute while those of *S. persistans* Banks are rounded. The respiratory siphon is rather slender, its apex being nearly circular.

The pupal stage lasts two to three days. The pupæ behave very much as those of the other species except that they swim with a longer stroke of the abdomen, thereby making fewer strokes to the minute.

Adult: This species has been described by Ludlow.[6]

[6] *Journ. N. Y. Ent. Soc.* (Sept., 1903), **11**; *Can. Ent.* (1904), **36**, 71; *Idem* (1905), **37**, 134.

Very great variety exists in this species, individuals emerging from the same batch of eggs showing marked instability of pattern. I do not propose to indicate or even suggest that they should be considered other than mere aberrations due to conditions of growth, but they at least demonstrate that there is a decided instability in this species or subspecies, whichever it may eventually prove to be. I indicate them with letters merely for convenience:

Var. a.—In this specimen there is on each side of the mesonotum at its base, a very thin, white line extending cephalad one-fourth the length of the segment, then curving outward exactly as the lyre pattern in *S. persistans* and *S. fasciata*. This curved line is very faint. Laterad to this line is a broad, straight, silvery, interrupted band from the prothoracic lobe to the base of the wing. Two specimens, both females.

Var. b.—The joints of the antennæ in this specimen, which is a male, are pure white on their margins. The median mesothoracic band is very faint.

Var. c.—This fine specimen has the lateral band of *var. a* extending dorsad to the base of the wing and terminating at the scutellum. The band is heavier and the scales are more distinct and quite silvery. The interruption is very slight, so that except under a lens the band appears as if continuous. It is confluent with the white, postocular cephalic band. Below this band on the anterior area of the mesoplura is another white band parallel with it, but terminating cephalad at the prothoracic lobe. The indications of the lyre-mark, although present, are very faint. It is a female.

Var. d.—This specimen has an abnormally broad median, white, longitudinal cephalic band. It is a male.

Var. e.—In this variety, the posterior tarsi are black, except for a very faint, white patch at the bases of the first and second segments. The lateral lobes of the scutellum are also black instead of silvery as in the typical specimen and in all the other varieties enumerated.

HABITS OF THE ADULT.

The adults of this species in the forest behave somewhat as those of *S. persistans* in houses, although they are not quite so persistent in their attacks. Their bite is equally as painful as that of the other species. Their average size is also greater and the note made by the vibration of the wings consequently has a lower pitch. It is easily possible to distinguish four distinct tones with males and females of both species together in a jar, those of the male of *S. persistans* being highest, those of the male of *S. samarensis* next, followed by those of the females respectively of *S. persistans* and *S. samarensis*.

In Manila, the adults of this mosquito are occasionally found in houses and their larvæ may be seen associated with those of *S. persistans* in the cups formed by bamboo fence posts. There is no means of distinguishing between the larvæ by a casual examination, and, economically, there is really no need to do so as they should both be placed in the "pernicious" class.

In dwellings, these mosquitoes fly during the same hours of the day as do *S. persistans,* but are to be encountered much less frequently.

HULECOETOMYIA PSEUDOTAENIATA Giles.

Stegomyia pseudotaeniata Giles, *Journ. Bombay Nat. Hist. Soc.,* **13,** 607.
———————————, *The Entomologist* (1901), **36,** 192.
———————————— Theobald, *Mono. Culic.* (1901), **1,** 312.
———————————— Giles, Handb. of Gnats (1902), 379.
Hulecoetomyia pseudotaeniata Theob., *Gen. Ins., Culic.* (1905), 20.
———————————— Banks, Philip. Journ. Sci. (1906), **1,** 986.
Hulecoeteomyia[7] pseudotaeniata Theob., *Mono. Culic.* (1907), **4,** 219.

This species, which lives in pot-holes in the rocks along the banks of rivers, may properly be considered a dry-season form owing to the fact that only during the dry season could it breed in abundance in such situations, as the water is then low and the rocks are fully exposed.

Very little is known at present with respect to the life history of this insect.

Egg: The egg has not been found.

Larva: The full-grown larva measures 7.5 to 8 millimeters. It is a very dark gray, almost black, the epidermis being somewhat iridescent.

The lateral thoracic setae are pectinate, and from three to five grow from each tubercle.

The pseudopoda are slightly less developed than in *Stegomyia samarensis* Ludlow and *S. persistans* Banks, which this species resembles very closely, both as larva and as adult.

The chief distinctive characteristic of this larva is the presence upon the frontal dorsal area of the head of 4 palmate bristles, each being 9–11-parted. Dorsad to the base of the antennæ on each side of the head is a 6-parted bristle. The abdominal bristles are arranged much as in *S. samarensis* Ludl.

The lateral comb of the eighth segment is remarkable in that its structure is entirely unlike *Stegomyia* and closely resembles that of *Culex lazarensis* Felt, described and figured by him from the State of New York.[8] Not only does the comb resemble that of *C. lazarensis* Felt, but the pecten scales are almost identical in shape and their number is only 5 less than that indicated in Felt's drawing.[9] Moreover, the siphon is provided with a 6-parted group of pectinate bristles at the distal extremity of each row of pecten scales as indicated in Felt's drawing.

The chitinous sclerite of the ninth segment has two rows of stout, dark spines on its posterior border; subdorsally and ventrad to these is a single, long bristle on each side.

The anal tracheal gills are three times the length of the ninth segment and, unlike any others that I have examined, are sharply conical, their surfaces being dotted with minute annular spots as in *Stegomyia samarensis.* The dorsal anchor bristles are six, the ventral from fourteen to sixteen.

HABITS OF THE LARVÆ.

The larvæ subsist upon decaying vegetable matter found in the pot-holes of the rocks in which they breed. They are very shy, hiding for a considerable time under leaves when disturbed.

[7] *Sic.*
[8] *N. Y. State Mus. Bull.* (1904), **79,** 310–311, fig. 48.
[9] *Idem* (1904), **79,** 311, figs. 50 and 51.

The larval period probably lasts for ten or twelve days, as a larva in the penultimate stage did not pupate for five days after capture and those in the last stage required three days before pupation.

Pupa: The pupa of this species resembles those of *Stegomyia* very closely with the following points of difference: the pinnuræ are circular in outline. The seventh abdominal segment has at its postero-lateral margin a 5-parted bristle while the eighth has one of nine parts.

The urochaetæ are straight and as long as the pinnuræ. The pupal stage lasts about three days.

Adult: The Philippine specimen corresponds in every respect with the description and drawing[10] by Giles, including the basal white patch on the costa.

HABITS OF THE ADULT.

Giles states that this mosquito is found in the lower Himalayas, Naini Tal and Bakloh, at 7,000 feet. In the Philippines, the altitude at which they occur is scarcely more than 35 meters. Giles further says. "I found them in a small collection of clean rain water, with some green *confervæ* in the cemented gutter round a house."[11]

I do not know whether these insects are addicted to sucking blood as I was not attacked by them during a week's stay in the region where they breed. All the specimens I obtained are from bred material.

Theobald[12] remarks that Giles' diagnosis with respect to the banding of the tarsi will not hold good for Australian specimens of the same species. This is likewise the case with Philippine specimens, the white bands involving both the bases and the apices of the joints.

This species has been found thus far in only a single locality in the Philippines, namely, at the Montalban gorge in the Mariquina River where the dam for the new Manila waterworks is being constructed.

THE FILARIA MOSQUITO.

CULEX FATIGANS Wiedemann.

Culex fatigans Wiedemann, *Aussereurop. zweifl. Ins.* (1828), 10.
——— aestuans Wied., *Ibid.* (1828).
——— pungens Wied., *Ibid.* (1828).
——— pallipes Meigen, *Syst. Beschr., Supp.* (1838).
——— anxifer Coquerel (Bigot), *Ann. Soc. Ent. Fr.* (1859), 117.
Heteronycha dolosa arribalzaga, *Dipt. Argent.* (1896), 56.
Culex macleayi Skuse, *Proc. Linn. Soc. N. S. Wales* (1896), 1745.
——— fatigans Theobald, *Mono. Culic.* (1901), **1**, 151.
——————— Giles, Handb. of Gnats (1902), 438.
——————— Theobald, *Mono. Culic.* (1903), **3**, 225.
———————————, *Gen. Ins., Culic.* (1905), 28.
——————— Banks, *Philip. Journ. Sci.* (1906), **1**, 986.

[10] A Handbook of the Gnats or Mosquitoes. London. (1902), 379, plate 14, figs. 8 and 9.

[11] A Handbook of the Gnats or Mosquitoes. London. (1902), 379.

[12] *Mono. Culic.* (1901), **1**, 314.

This mosquito is by far the commonest species to be encountered in coast towns in the Philippines. It is a night flier, never attacking before 5 o'clock in the afternoon and seldom biting after 12 midnight.

Egg: The eggs of *Culex fatigans* are laid in concave rafts which float upon the surface of the water. (Pl. VII, fig. 1.) These rafts are usually about three times as long as they are broad and contain from 180 to 350 eggs, usually in six to eight rows varying in length, as will be seen on Plate IX. These diagrams represent the shapes of 18 egg-masses laid in a jar of rain water in the Entomological Laboratory during the night of September 18, 1907.

Length, 0.70 millimeters; of a dark gray, somewhat iridescent. The egg has a detachable, cup-shaped operculum at the base (Pl. VIII, fig. 2), which opens back when the larva emerges, but which is frequently not entirely detached from the remainder of the egg-shell. In the center of the operculum is a tiny protuberance or spine which, in each egg, passes downward through a small hole in the center of a very small circular fringe. This fringe is composed of radiating, elastic filaments which, when the egg touches the water, spread out in the form of an inverted saucer and support the egg in an upright position (Pl. VIII, fig. 2). It has been found by experiment that a single egg, if carefully placed upon the surface film with the tips of the fringe touching the water, will retain its vertical position. As the eggs are deposited they touch each other along their sides, and, owing to the upper end being less than the lower in diameter, the final result is a concave raft of eggs, each standing upright and being slightly glued to its neighbor. When the egg leaves the ovipositor of the female, which it does large end first, the extremities of the fringed cap are drawn together so that the cap has the appearance of a tiny sphere adhering to the end of the egg. Upon touching water this expands as before mentioned.

Larva: The very young larvæ are pure white and very active. In hatching they increase their length about twice, so that they measure 1.5 to 1.6 millimeters when they emerge. Length of full-grown larva, 7.5 to 8 millimeters. (Pl. VIII, fig. 3.) It is dark gray, the eye-spots being nearly black. The head is subspheroid, being slightly subtriangular anteriorly. The antennæ are one-half as long as the head, slightly curved. The first segment is spinous on the outer convex surface and around its entire basal area. At a point two-thirds the distance from the base is a small tubercular shoulder or notch upon which grows a cluster of about 24 to 26 pectinate setæ, each one of which is more than one-half of the length of the entire antennæ.

These setæ, in living specimens, are spread out in the form of a fan (Pl. VIII, fig. 4), but may be closed up voluntarily by the insect when it is not feeding. Four simple bristles project from the apex of the first segment, located two on either side of the base of the second segment.

Six groups of pectinate bristles are found across the frontal area, one at the base of each antenna containing twelve branches and four submedian of six and eight branches, those with eight being nearer the median line.

Mediad to each eye-spot is a simple and a trifid seta.

A row of simple, bifid and trifid bristles extends across the anterior area of the thorax.

Slightly dorsad to each of the middle pseudopoda is a minute, plumose bristle. The posterior pseudopoda are well developed. Dorsad to these are numerous pectinate bristles in a single cluster on a slight tubercle, while the fore, mid and posterior pseudopoda are provided with clusters of long, pectinate setæ.

Lateral, pectinate bristles grow from the first and fourth abdominal segments, two or three on each tubercle, those on the first and second segments curving

anteriorly. Numerous other simple or tiny plumose setæ are found upon the remaining segments.

The eighth abdominal segment is two-thirds the length of the four preceding (Pl. VIII, fig. 5.) The respiratory siphon, which is twice the length of the eighth segment, is completely chitinous and is usually held at an angle of nearly 90° to the longitudinal axis of the body. Upon its ventral surface it has four groups of 5- or 6-parted pectinate bristles, situated about midway from base to apex, and another group composed of four short bristles half-way from the last of these to the apex; dorsally a single bristle two-thirds distant from the base. The pecten is composed of eight to eleven scales according to the individual specimen. These scales are quite similar in shape to those of *Culex restuans* Theob., delineated by Felt,[13] except that one tooth is much longer than any of the others.

The lateral comb of the eighth segment is composed of about forty-two scales similar in form to those of *C. lazarensis* Felt.[14]

At the base of the siphon, on the eighth segment, is a single stout bristle, ventrad to which is a group of eight pectinate setæ. At the posterior ventro-lateral margin of the eighth segment, near the point of union of the ninth, is another group of six pectinate setæ.

The ninth segment bears a chitinous annular sclerite, the posterior margin of which is undulate and the posterior dorsal area of which is finely setose.

The ventral anchor bristles are in twelve groups, each of which is composed of two compound setæ. The dorsal anchor bristles are six, two of which are two and one-half times the length of the respiratory siphon.

The anal tracheal gills are of the same length as the ninth segment, taper to an acute apex and have a few irregularly placed annular spots.

The length of the larval period in *Culex fatigans* is from six to eight days.

These larvæ breed almost exclusively in rain barrels and in water tanks in houses. Another favorite place is in the large cans used for drinking water or for rain water caught from gutters. The larvæ find sufficient food in the decaying particles of nipa which wash down from thatched roofs or from the sides of rain barrels. They hang nearly vertically in the water, but they frequently feed at the surface, in which case the siphon is used as a pivot and the animal's head moves around in a circle, the body being also curved to form a half circle.

Pupa: Length over dorsum 5.5 millimeters, color light brown changing to dark brown a day before the adult emerges. The respiratory siphons are of normal shape and minutely setose externally. (Pl. VIII, fig. 6.)

The second abdominal segment bears a pair of flat, plumose setæ while those of the first segment, although plumose, have but few (six to seven) branches.

The third, fourth and fifth segments bear tiny compound setæ dorsally, those of the third and fourth being near the posterior margin, those of the fifth being discal and submedian. In addition, each segment is provided with long, simple bristles on the posterior lateral margins. On each side of the posterior margin of the eighth segment are three tiny setæ: simple, bi- and trifid respectively, extending externally from the median line.

[13] *N. Y. State Mus. Bull.* (1904) **79**, 327, fig. 71.
[14] *Idem* (1904) **79**, 310, fig. 48.

The pinnuræ are subcircular, their margins being excavated internally at the base. They are devoid of cilia and are very minutely rugose or setose. The urochaetæ are very short, being less than one-tenth the length of the pinnuræ.

The pupal stage lasts two to three days.

Adult: Length, 4 to 5 millimeters. (Pl. X, fig. 1.) The general color is light brown. In perfectly fresh specimens three faint, dark brown, parallel longitudinal lines are visible on the mesothorax, but in old specimens this is less apparent, unless they are denuded.

The hair-like scales of the mesothorax are golden in certain lights. In addition, there are four well defined longitudinal rows of dark curved setæ, two submedian and two sublateral, on the mesothorax.

The abdominal segments are clothed basally with flat, pale ochraceous scales, causing the appearance of transverse banding on the abdomen.

The legs are uniformly dark brown and the proboscis, which is also dark brown, is unbanded, thereby distinguishing this species from *C. microannulatus* Theob., the only other mosquito with which it might at first sight be confounded, except the occasional *Mansonia uniformis* Theob., which may be at once distinguished, by the layman, by its brown and ochraceous, banded legs.

HABITS OF THE ADULT.

This species is a domestic form *par excellence,* breeding only in or near houses in the Philippines and causing more real annoyance than any or all other species combined. It begins its attacks at nightfall, and the pests may be seen as early as 6 o'clock, pouring into open windows and doors in cohorts. Their humming can be heard continuously in a quiet room, especially if it is closed. Hardly a district in Manila is free from these mosquitoes and they are found in all the towns near the coast that I have visited. The style of architecture prevalent in Philippine towns, where the water tanks, reservoirs, bath-tubs, cisterns, etc., are built in with the structure, and where, in later days, these receptacles remain unused or superannuated, lends itself readily to the harboring and breeding of *Culex fatigans,* and I think it can be stated that without doubt every house harbors and breeds its own supply of these pests. Invariably, when I have been called upon to visit a house especially plagued with *C. fatigans,* I have found larvæ actually breeding in plain sight in sufficient numbers to supply two such dwelling houses with adults.

Being, as they are, purely domestic, these mosquitos are amenable to such simple remedial or prophylactic measures as to render it surprising that people suffer themselves to be exposed to an annoyance and menace to health which is so easily to be prevented. In every case a few drops of petroleum placed on the surface of the water which may afterward be drawn from the bottom of the receptacle without danger of taint, or the emptying of some unused vessel, will destroy thousands of larvæ and prevent the females from depositing their ova. It seems

probable that *Culex fatigans* is a carrier of filaria and a transmitter of dengue,[15] and therefore the question of its destruction carried on in a systematic and coöperative manner assumes greater importance.

The attitude of this mosquito when at rest is so characteristic and so different from that of any other species, that I have drawn a female, shown on Plate IX, fig. 2. The position of the head and proboscis, the hind legs and abdomen are especially to be noted. Both males and females assume this attitude. When a dark garment or a hat is moved or a clothes closet is opened during the day, many individuals will at once fly forth, taking to another dark recess where they may hide.

I have successfully proved in my own dwelling in Manila that there is no need to be molested by this insect, although I live almost entirely surrounded by waterways and only a few meters removed from a salt-water swamp. I seldom see a mosquito in this place, either during the day or night. I personally empty all receptacles where *Stegomyia persistans, S. samarensis* and *Culex fatigans* might breed, and so the only individuals that enter, and they get in only at rare intervals, are those that come from my neighbors' houses, the nearest of which is 10 or 12 meters away.

BANKSINELLA LUTEOLATERALIS Theob.

Culex luteolateralis Theob., *Mono. Culic.* (1901), **2**, 71.
————————, Giles, Handb. of Gnats (1902), 448.
————————, Giles, *Journ. Trop. Med.* (1904), **7**, 368.
————————, *Gen. Ins., Culic.* (1905), **27**, 987, 998.
Banksinella luteolateralis Theob., *Mono. Culic.* (1907), **4**, 469.

This mosquito has been found by me in but one locality in the Philippines, namely, in nearly dry, grassy ditches behind the laboratory building of the Bureau of Science in Manila.

Insects were collected in July, in the late afternoon, between 5 and 6 o'clock. Individuals of this species settle very readily upon the hand and are not very easily frightened away. Several specimens, caught by placing vials over the mosquitoes as they alighted, bit very readily.

Their larvæ have not yet been found, but some females placed in captivity laid a few eggs separately upon the surface of the water, always near the edge of the vessel in which they were confined. However, these eggs did not hatch, so nothing is known of their life history.

Egg: The egg measures 0.63 millimeter in length, is very dark brown and irregularly oval in outline, one end being slightly more acute than the other. The surface is covered with circular, flat air-cells which are very minute at the extremities and sightly larger in the middle. The form of this egg is more like that of *Stegomyia* than of *Culex*.

[15] Ashburn and Craig: *This Journal, Sect. B.* (1907), **2**, 128.

Theobald has already taken this insect out of *Culex* and placed it in the genus indicated,[16] basing his action upon palpal and other characters.

MANSONIA ANNULIFERA Theob.

Panoplites annulifera Theob., *Mono. Culic.* (1901), **2**, 183, Pl. XXX, fig. 120, text fig. 244.[17]
———— ———— Giles, Handb. of Gnats. London (1902), 356.
Mansonia annulifera Ludlow, *Can. Ent.* (1904), **36**, 299; *idem.* (1905), **37**, 734.
———————— Theob., *Gen. Ins., Culic.* (1905), 32.
———————— Banks, *Philip. Journ. Sci.* (1906), **1**, 989.

This species, like the other two of *Mansonia* reported from these Islands, is evidently very obscure in its breeding habits, as nothing has been recorded with reference to it.

It is fairly common in certain localities in the Philippines, especially near Manila, and it is only a question of time when its breeding places and habits will be known.

A female captured at night on September 12, 1906, laid eggs on the same night on the edge of the water in the vessel in which she was confined.

Egg: The egg, when recently laid, is pale buff colored, measures 0.82 millimeter in length and at one end has a very narrow neck like a bottle. The surface is finely granulated and at the neck end are numerous flat, circular air chambers as shown on Plate X, fig. 3.

These eggs float horizontally upon the surface of the water, near the side of the vessel.

The adults of this species have never been found by me to bite or act as if desirous of biting, although the habit possessed by its near relative *Mansonia uniformis* Theob. is probably to be attributed to this species also.

MANSONIA UNIFORMIS Theob.

Panoplites uniformis Theob., *Mono. Culic.* (1901), **2**, 180.
Mansonia africanus Theob., *Ibid.* (1901), **2**, 187.
———— australianis Giles, Handb. of Gnats. London (1902), 355.
Panoplites uniformis Giles, *Ibid.*, 253.
Mansonia uniformis Ludlow, *Can. Ent.* (1905), **37**, 134.
———————— —— Banks, *Philip. Journ. Sci.* (1906), **1**, 989.

Nothing is as yet known of the life history of this very abundant species, but some interesting observations have been made concerning the females. They are rather sluggish in flight and are not easily alarmed when seeking to bite a person. These mosquitoes begin to enter dwellings which are situated near forests about dusk and may continue to be annoying until 11 or 12 o'clock at night. In the field they begin to

[16] *Mono. Culic.* (1907), **4**, 469.
[17] This reads, "text fig. 224" in *This Journal* (1906), **1**, 989, in error.

bite as soon as it is sufficiently dark to prevent their being seen except in profile against the sky. The sting is very sharp, but it lasts only for a short time as compared with that of *Culex fatigans* Wied., or *Stegomyia persistans* Banks. It is almost impossible for these insects to fly when they are filled with blood; indeed, it is with difficulty that they can lift themselves from the surface upon which they are standing.

At Los Baños, La Laguna Province, on the evening of February 23, 1908, I captured two females of *Mansonia uniformis* Theob., one of which was infested with 7 mites and the other with 1; these were clinging to the abdomen. These mites probably belong to the family *Trombiidæ*. As the forms were all young, it is impossible to identify them, but I hope to find the adults and thus be able to place the species to which they belong. As the mosquitoes were captured when it was nearly dark and at random, and as two out of three captured were infested, it is reasonable to suppose that this is a common parasite for this mosquito. Very few mosquitoes are known to have parasites, at least in the adult stage. The parasites in question measure 0.5 millimeter in length and are of a pale vermilion, retaining this color even after two months in formalin-alcohol. The individuals, in these cases, were found adhering by the proboscis to the abdominal sutures and in drying remained attached to the host.

It is my opinion that *Mansonia uniformis* Theob. may play an equally important rôle in the transmission of dengue fever as does *Culex fatigans* Wied., even if the latter be fixed upon conclusively[18] as a transmitter. This mosquito has been reported from all the points in the Philippines where dengue has occurred among American soldiers as an epidemic during the last few years.

[18] Ashburn and Craig: *This Journal, Sect. B.* (1907), 2, 128.

LIST OF ILLUSTRATIONS.

PLATE I.

FIG. 1. Egg of *Worcesteria grata* Banks.
(*a*) Showing granular nature.
(*b*) Showing difference in size of granules.
(*c*) Showing structure of single granule.
(*d*) Showing manner of rupture of shell upon hatching of larva.
2. Full-grown larva of same.
3. Eighth and ninth abdominal segments of larva showing setæ and respiratory siphon.
4. Pupa of *W. grata* Banks, showing pinnura enlarged at (*a*).

PLATE II.

Adult male of *W. grata* Banks.

PLATE III.

Adult female of same.

PLATE IV.

FIG. 1. Egg of *Desvoidya joloensis* Ludlow showing reticulation and air cell pattern.
2. Full-grown larva of same.
3. Eighth and ninth abdominal segments of larva showing setæ and respiratory siphon.
4. Pinnura of pupa showing urochaeta curved at base.

PLATE V.

Adult male of *Stegomyia persistans* Banks.

PLATE VI.

Adult female of same.

PLATE VII.

FIG. 1. Egg of *Stegomyia samarensis*.
2. Larva of same.
3. Eighth and ninth abdominal segments of larva showing setæ and respiratory siphon.

PLATE VIII.

FIG. 1. Egg raft of *Culex fatigans* Wied.
2. Single eggs showing cap at base, reticulation of shell, mode of floating on water and appearance after larva has emerged.
3. Full-grown larva of same.
4. Position of larva at surface of water.
5. Eighth and ninth abdominal segments of larva showing setæ and respiratory siphon.
6. Pupa of *C. fatigans* in natural position.

Plate IX.

Diagram of eighteen egg rafts of *Culex fatigans* Wied., laid in a single night in a jar in laboratory, showing relative lengths of the egg rows.

Plate X.

Fig. 1. Adult female of *Culex fatigans* Wied.
2. Adult female of *Culex fatigans* Wied. in resting position.
3. Egg of *Mansonia annulifera* Theob., showing peculiar shape and large air cells near neck.

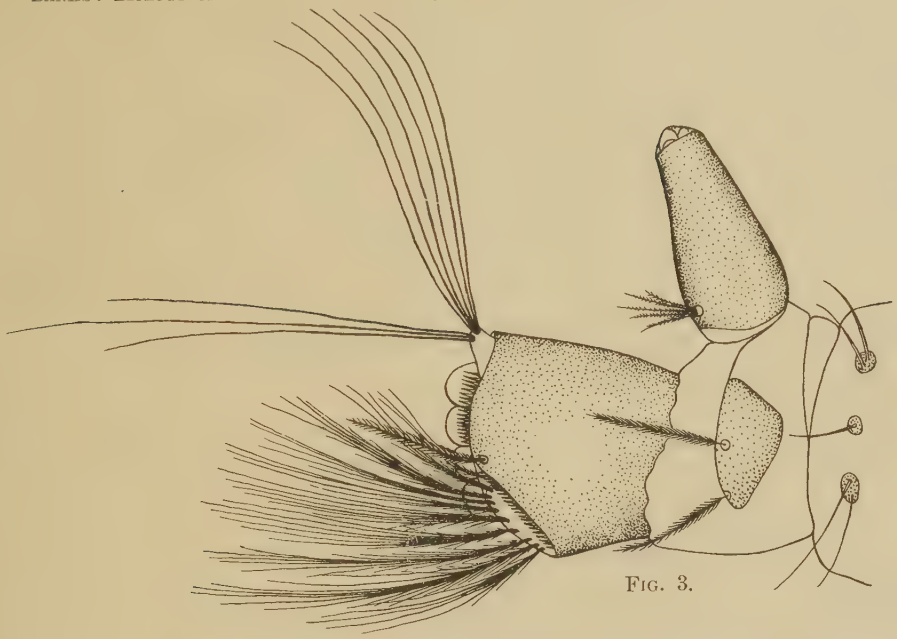

FIG. 3.

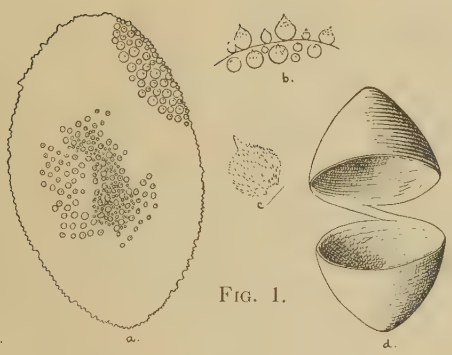

FIG. 1.

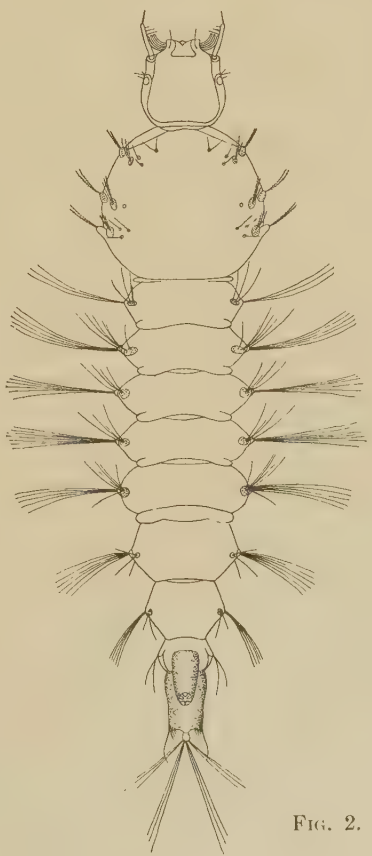

FIG. 2.

FIG. 4.

PLATE I.

PLATE II.

PLATE III.

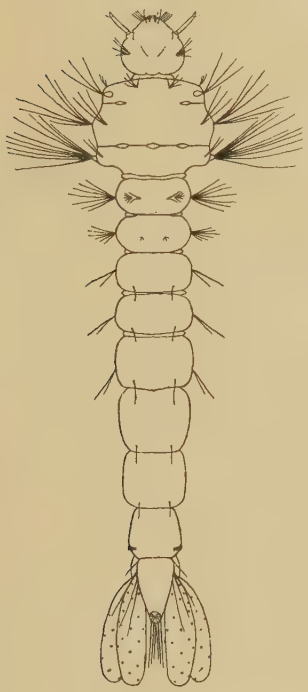

FIG. 2.

FIG. 1.

FIG. 4.

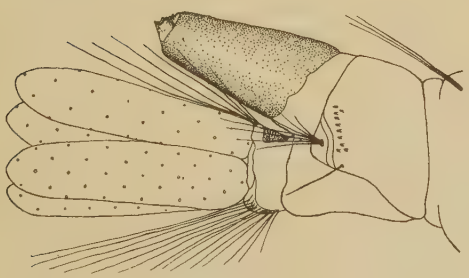

FIG. 3.

PLATE IV.

PLATE V.

PLATE VI.

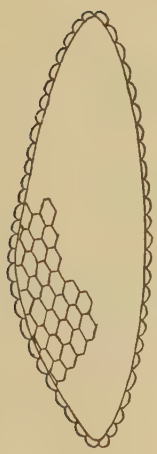

FIG. 1.

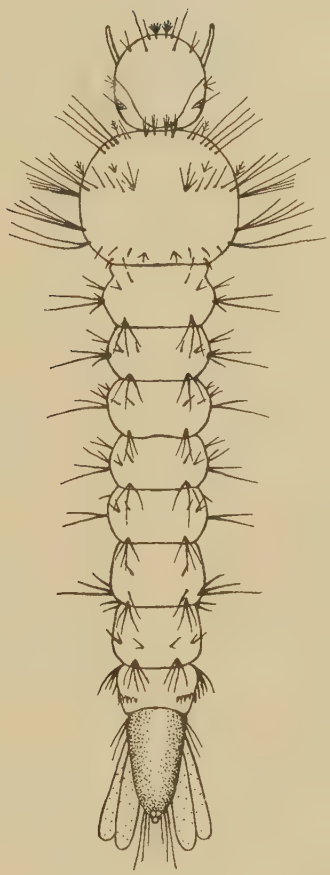

FIG. 2.

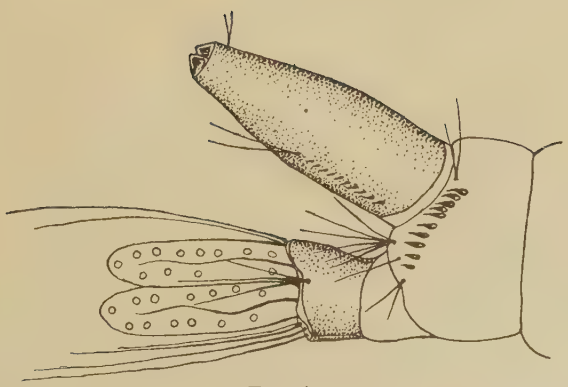

FIG. 3.

PLATE VII.

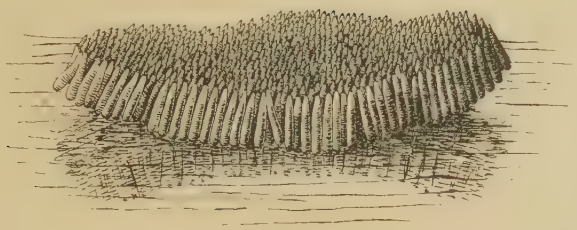

FIG. 1.

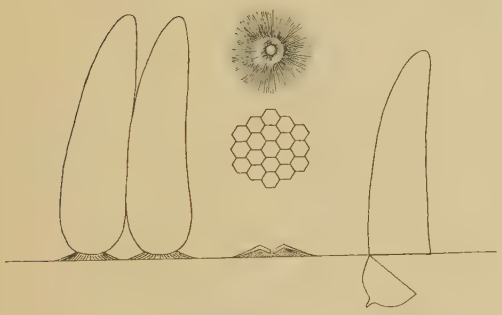

FIG. 2.

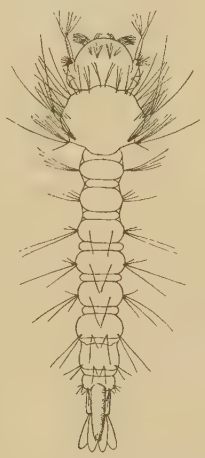

FIG. 3.

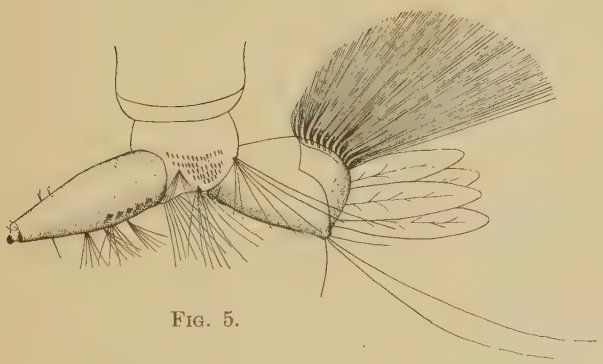

FIG. 5.

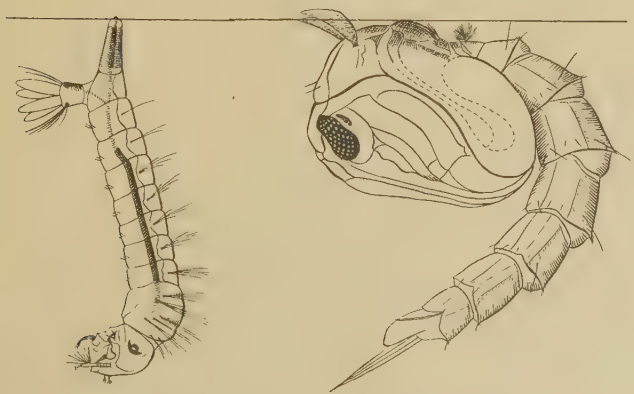

FIG. 4.

FIG. 6.

PLATE VIII.

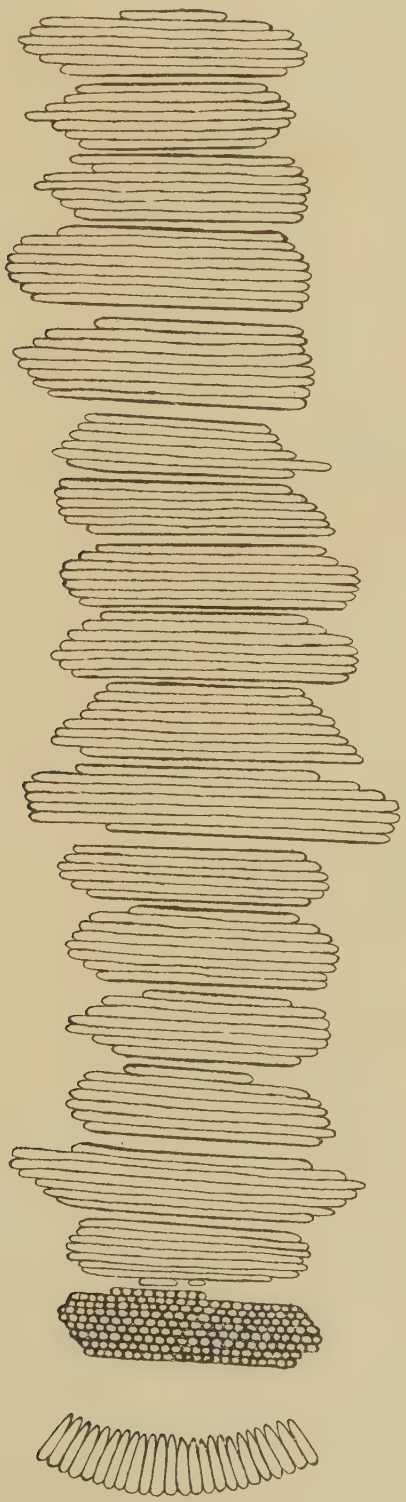

PLATE IX.

FIG. 1.

FIG. 2.

FIG. 3.

PLATE X.

DESCRIPTION OF NEW CASSIDIDÆ OF THE PHILIPPINE ISLANDS.

By J. Weise.
(*Berlin, Germany.*)

Prioptera schultzei sp. nov.

Subrotundata, nigra, nitida, elytrorum disco saturate brunneo-rufo, parum nitido, fortiter subrugoso-punctato, bicarinato, uni-foveolato, antice leviter gibboso. Long. 11–12 mm.

Bongabon, Mindoro, P. I.

Time of capture: January, 1908. (W. Schultze, collector.) No. 8383 in Entomological collection, Bureau of Science, Manila, P. I.

Belongs to the species which have a large pit on the elytra and is distinguished not alone by its very peculiar coloring, but also by the coarse and wrinkled punctuation of its elytra.

Deep black, glossy, the inner edge of the epipleuræ and a narrow indistinct marginal stripe of the abdomen reddish, discal part of the elytra decidedly brownish-red and not very glossy. Front, thorax, scutellum and the lateral slope of the elytra are nearly smooth. The latter has a broad ridge in the middle and is divided from the discal part by a row of coarse punctures, which are behind the middle, pitlike, and divided by cross ridges. The thorax has a slight, flat medial groove, which runs posteriorly into a pit before the middle lobe. The elytra are a very little broader at the base than the thorax, enlarged slightly in the first quarter and smoothly rounded, then less so up to the last third and nearly straight; beyond that they are abruptly narrowed, running also nearly straight into the sharply pointed apex. The basal triangle extends to a low, united, uneven cross ridge, and is separated by the first longitudinal ridge, which in common with the second larger one surrounds the shallow pit on the discal part behind the cross ridge.

This interesting species is named in honor of Mr. W. Schultze of Manila, who found it in all stages of development on the coast of Mindoro.

Cassida (Odontionycha) picifrons sp. nov.

Breviter ovalis, convexiuscula, dilute viridi- vel testaceo-flava, nitida, antennis testaceis apice leviter infuscatis, capite piceo, fascia lata metasterni nigra, ventre in medio infuscato, elytris punctato-striatis, protecto modice explanato, sat deflexo, sat crebre punctato. Long. 3.5–4 mm.

Manila, P. I.

Time of capture: January, 1908. (W. Schultze, collector.) No. 8619 in Entomological collection, Bureau of Science, Manila, P. I.

This species is closely related to the East Asiatic *C. obtusata* Bohem., but is not so broadly built and is easily distinguished by its darker head.

Broad-oval shaped, slightly arched, glossy pale greenish-yellow, or on the discal part of the upper side light brownish-yellow, the lateral slant lighter, greenish or yellowish. Antennæ reddish-yellow-brown, the last joints broad and slightly darkened. Head pitch-brown, front nearly smooth, the anterior margin evenly rounded (♂), or drawn forward above the head a little, the corners small, rounded and situated at about two-thirds of the whole length. Elytra at the base slightly rounded, the somewhat acute shoulders a little broader than the thorax, the posterior portion slightly widened, then curved, posteriorly strongly narrowed and the apices uniformly rounded. The discal part punctate-striate, with a few regular, somewhat raised intermediate striae, the slanting part not so closely and deeply punctate as the striae. The under side and legs of a similar color to that of the upper side. Metathorax with a broad transverse black stripe. The middle of the abdomen and especially toward the anterior half of it blackish diffused.

LIFE HISTORIES OF SOME PHILIPPINE CASSIDIDÆ.

By W. Schultze.

(*From the Entomological Section, Biological Laboratory, Bureau of Science, Manila, P. I.*)

INTRODUCTION.

During the months of November and December, 1907, my attention was attracted by the abundant appearance of certain species of *Cassididæ* on plants in the vicinity of Manila. This opportunity as well as the interesting accounts of this family by Muir and Sharp [1] induced me to work out some life histories of Philippine *Cassididæ*. I wish to express my thanks to Mr. J. Weise, Berlin, who was so kind as to identify the species described in this paper.

Prioptera sinuata Oliv. (Pl. VI, fig. 2).

Prioptera sinuata Oliv., *Encyl. Méth.*, (1790) *V*, 392.

Egg: The eggs are always laid singly on the underside of the leaves. The female at first deposits a thin layer of a gelatinous substance upon the leaf, and this, coming in contact with the air, dries very quickly. She then lays her eggs upon this substance and covers them with another, very thin, gelatinous layer. The egg is thus inclosed in a flat, semi-transparent case. (Pl. I, fig. 1.) An irregular, roof-like cover is placed over the whole length of the primary case, fastened to the egg-case by one end only, the latter being pointed. This upper layer has an undulating structure. (Pl. I, fig. 2.) In the majority of cases,[2] a few particles of excrement are found on the upper cover.

Larva: The young larva of *P. sinuata* Oliv., when newly hatched, is yellowish, the head light brown; later, but before the first molt, the general color becomes light brown; head, black; the chitinous plates on the prothoracic segment and the two large subanal spikes also black. The larva has eight dull-pointed, curved and fleshy spines on the prothoracic and two short tubercles and two curved spines on each of the meso- and metathoracic segments; first to sixth abdominal segments, each

[1] *Trans. Ent. Soc.* London, (1904), 1–21, pls. 1–5.

[2] My statement is based upon the observation of about 250 egg-cases of this species.

with two fleshy, curved, hooked spines decreasing in size toward the anal segment; seventh and eighth segments, each with two large, evenly curved, pointed spines, and ninth segment with a forked pair of very large and strong subanal spines. All spines, except the subanal, are beset with numerous small tubercles which have short bristles. There are also numerous, very small tubercles scattered over the body of the larva. On the thoracic spines the base is black, but toward the apex light brown, all other spines having the latter color. The stigmata are white, their centers brown. The larva of this species (Pl. I, figs. 3 and 4) has the habit of placing its excrement in the form of very long, irregular filaments upon the subanal spines, not forming a solid shield, as a whole, but having the filaments arranged in such a shape or manner that the mass appears like a black, fungous growth. The exuviæ are entirely covered so that only cephalic exuviæ of the last molt are visible just above the anus. The evaginating anus of *P. sinuata* Oliv. is longer than that of any other of the six species described in this paper and it is a most curious sight to see this apparatus in action.

Ventrally, the cover or shield is somewhat smooth, modeled in such a manner that it conforms to the dorsal outline of the body when carried close to the latter. In this species as well as in the others which I have observed, the larva, shortly before each molt, fastens itself with a glue to the leaf so that it has a good hold when pupating. During the period from the fourth molt to pupation, the larva puts most of its excrement as a secondary lump on top of the old cover and as the excrement disposed of in this way is not pasted on to the shield solidly, it falls off when dry.

LIFE HISTORY.

	1907.		1907.
Egg laid	November 15	Third molt	November 28
Egg hatched	November 20	Fourth molt	December 3
First molt	November 21	Pupated	December 9
Second molt	November 24	Adult emerged	December 15

The full-grown larva casts the excremental shield about half a day before pupating. Only the exuviæ of the fifth larval stage remain on the last segment of the pupa.

Pupa: The pupa of *P. sinuata* Oliv. (Pl. I, fig. 5) is very different from that of any of the other genera of this family so far as is known to me. The pronotum is very short and very wide. It has two short tubercles in front and four curved, fleshy, dull-pointed spines. The meso- and metanotum are without spines. The abdominal spines of the larva are changed in the pupal stage into flat, fleshy, somewhat curved and spatulate hooks; those on the first and second abdominal segments are very large and curve anteriorly; the others decrease in size and curve

toward the anal segment, as in the larval stage. The whole dorsal surface of the pupa is covered with numerous, small tubercles. The stigmata are of moderate length.

This species feeds on *Premna vestita* Schauer.

PRIOPTERA SCHULTZEI Weise (Pl. VI, fig. 1).

Prioptera schultzei Weise, *Philip. Journ. Sci.* (1908), **3**, 269.

The egg-case of this species (Pl. I, fig. 6) contains, as in *P. sinuata* Oliv., only one egg and is somewhat similar in general appearance to that of the species just described. It consists of a primary layer fastened to the leaf, on which the egg is laid; it has an irregular, thin, flattish cover over the whole with a curiously shaped, longitudinal bar fastened on top of it. This longitudinal bar is pointed at one end and on the other it runs out into several irregular, flat appendices. Laterally it has a number of broad, raised crossbars. The whole structure reminds one of the shape of the vertebral column. Some particles of excrement are found on the egg-case.

Larva: The larva of *P. schultzei* Weise (Pl. I, fig. 7) differs from that of *P. sinuata* Oliv. in the following respects. The forked spines on the prothoracic segment are straight and nearly perpendicular to each other; other spines on the pro-, meso- and metathoracic segments are straight, being unlike those of *P. sinuata* Oliv. The latter species also has the first pair of spines on the meso- and metathoracic segments developed only as short tubercles; in *P. schultzei* Weise, these spines are well developed, straight, and nearly as long as the second pair. In *P. sinuata* Oliv. the large subanal spines are curved in a peculiar way (Pl. I, fig. 5, larval skin on pupa), although in *P. schultzei* Weise they are curved to form a loop coming in contact at the middle and then recurved again. (Pl. I, fig. 8.) The excremental shield of the larva of this species, although in structure very similar to that of *P. sinuata* Oliv., is much more solid, the long filaments more regularly arranged, and, as a whole, the shield is more nearly circular. The color of this shield is not black, as in the former species, but, with reference to age, older excremental filaments are darker gray than younger ones, which are sometimes even whitish. Shortly before pupating, the larva casts off the excremental shield and as in *P. sinuata* Oliv. only the last larval exuviæ remain on the pupa. (Pl. I, fig. 8.) The latter differs from that of *P. sinuata* Oliv. in the following details: tubercles on the pronotum not as strongly pronounced and shorter; flat, spatulate hooks on the first and second abdominal segments larger and more sharply curved; the pair on the third segment very long and narrow, pointed, triangular and bent toward the anal segment; the general color of the pupa is porcelain-white, mesonotum light brown; two small light-brown spots occur on

the pronotum and fourth abdominal segment, and two large, black spots on the metanotum and on each of the second and third segments.

I found this species feeding on *Premna integrifolia* Linn. on a dry and sandy beach, near Bongabon on the east coast of Mindoro, P. I., in the month of January, 1908, in all stages and quite numerous.

ASPIDOMORPHA MILIARIS Fabr. (Pl. VI, fig. 6).
Aspidomorpha miliaris Fabr., *Syst. Ent.*, (1775), 91.

Egg: The egg-case of *A. miliaris* Fabr. (Pl. III, fig. 1) is a very remarkable and complete structure, similar to that of *A. puncticosta* Bohem., and the latter is so well described by Muir [3] that it is not necessary for me to repeat his statements concerning the process and manner by which the oötheca is built up. However, I found that the egg-clusters of *A. miliaris* Fabr. differ greatly in size and in the number of eggs which they contain. The number of eggs in one oötheca varies from 32 to 80.[4] All oötheca which I observed have eight longitudinal rows of cells. The four middle rows contain the eggs; the others, two rows on each side, being air chambers. The complicated structure of the egg-case of *A. miliaris* Fabr. alone, indicates that this species is much more advanced in its development than its near relatives.

Larva: Larvæ of *A. miliaris* Fabr. always live in groups or communities and they pupate together. The newly hatched larva of *A. miliaris* Fabr. is light ochraceous-brown. In this species, also, the subanal spines are extremely long. The larva has eight spines on the pro-, four on the meso-, and four on the metathoracic segments; abdominal segments each with two spines. All the spines are nearly straight, those on the seventh, eighth and ninth segments are longer than the others, and the forked subanal spines on the ninth segment are curved. Numbers of white spinules occur on all spines. The color of the spines is dark, with lighter-brown toward the base. Head and legs are also dark brown, lighter along the sutures. The general color of the larva (Pl. III, figs. 2 and 3) is creamy-white, but toward the margins and segmental articulations ochraceous. On the prothoracic segment, indications of a chitinous sclerite appear, marked with two irregular, dark-brown spots. The mesothoracic segment has two black antemedial and two brown submarginal spots; metathoracic segments with two large, black antemedial, four smaller, submarginal brown spots, and one small, black, nearly round, medial spot on the posterior half of the segment. First to seventh abdominal segments, each with two irregular, oblong, black antemedial, two submarginal, and one small nearly round medial spot, the latter on the posterior half of each segment. The seventh

[3] *loc. cit.*, p. 2.
[4] Observation of 16 egg-clusters.

segment has two medial spots. All spots are arranged in longitudinal rows. Stigmata white and of moderate length. The larvæ of *A. miliaris* Fabr., when feeding, place themselves in a single row close together along the margin of the leaf; however, when resting, they form an oval figure all heads being directed toward the center. (Pl. II.) The exuviæ are carried perpendicularly to the body. The habit of pasting the particles of excrement on the exuviæ is still indicated in this species, as the larva puts its filaments very loosely on the last exuviæ, but these filaments fall off at the slightest motion of the larva. The full grown larva, about two days before it pupates, fastens itself upon the leaf with a glutinous substance generally head downwards. Only the fifth larval skin remains on the pupa. During the pupal stage, as in the larval, the individuals remain in groups. (Pl. IV.)

LIFE HISTORY.

	1907.		1907.
Eggs laid	November 5	Third molt	November 24
Eggs hatched	November 15	Fourth molt	November 28
First molt	November 17	Pupated	December 8
Second molt	November 21	Adults emerged	December 13

Pupa (Pl. III, fig. 4): Yellowish-ochraceous, two black spots at the posterior margin of the pronotum and two antemedial spots on each of the first and second abdominal segments. The pronotum of the pupa is about twice as broad as long; marginal area semitransparent and with four short, dark brown hooks in front. The spines on the first to the fifth abdominal segments of the larva are developed in the pupa into flat, semitransparent leaflets prolonged laterally into a black spine. All other spines of the larval stage are absent in the pupal. Stigmata of moderate length. The food plants of *A. miliaris* Fabr. are *Calonyction bona-nox* Boyer, *Ipomœa triloba* L., and *Ipomœa pes-caprœ* (L.) Roth.

Adults: The adults of *A. miliaris* Fabr. (Pl. VI, figs. 6–9) are extremely variable, with reference to coloring. Fig. 6 represents the most common form. The direction in which the change of coloring takes place is as follows: the black spots become enlarged and connected by longitudinal or transverse bars. (Pl. VI, figs. 7 and 8.) The variation shown in fig. 9 is a rare form. In this the central portions of the elytra are entirely black. Whether or not these variations are due to seasonal dimorphism must be left for further research.

I have noticed instances of very peculiar behavior on the part of all species which were closely observed. In the act of copulation, the female puts the fore and middle legs close together, attempting by strong, sidewise motions to shake the male off. It appears that by doing so, this female coquetry has the contrary result, and it suggests seduction on her part. *"Cum finis est licitus, etiam media sunt licita."*

CASSIDA PICIFRONS Weise (Pl. VI, fig. 3).

Cassida (Odontionycha) picifrons Weise, *This Journal*, current number.

Egg (Pl. III, fig. 5): in a thin primary case, fastened to the leaf by a very thin, semitransparent and smooth cover. The eggs are laid singly, rarely in pairs, but always under an individual cover, on the underside of the leaf. Usually some particles of excrement are found on the cover.

Larva: The young larva very much resembles that of *M. trivittata* Fabr., not alone in shape, but also in its behavior, as it places its excrement in a like manner on the long, subanal spines, but forming a more irregular and loose lump than that of *M. trivittata* Fabr. The very young larva is yellowish-white, later the color becomes light green and as the skin appears transparent, the different organs are visible as lighter or darker markings. The first pairs of inner spines of the prothoracic segment are curved, the others straight and all of about the same length. The first pair on the meso- and metathoracic segments are two-thirds the length of the second pair, which are as long as those on the prothoracic segment; spines of the first to fifth abdominal segments smaller than the former, decreasing in length toward the latter segment. The spines on the sixth to eighth segments increase in size again, the ninth segment having the longest spines. The spines have spinules on them similar to those of *M. trivittata* Fabr. These larvæ (Pl. III, fig. 6) place their excreta loosely between the different exuviæ.

LIFE HISTORY.

	1907.		1907.
Egg laid	December 2	Third molt	December 16
Egg hatched	December 7	Fourth molt	December 20
First molt	December 10	Pupated	December 23
Second molt	December 12	Adult emerged	December 26

Pupa: The pronotum of the pupa (Pl. III, fig. 7) is not as rounded as in *M. trivittata* Fabr.; the surrounding spinules are somewhat irregular in length. First to fifth abdominal segments lamellated and surrounded by spinules. Lamellation on first to fourth segment drawn out into very long spines. Stigmata white, tracheæ[5] excrescent, the relative length of each to the other being as follows: tracheæ of first and second segments equal, one-third the length of that of the third segment; of the fourth segment twice as long as the one on the first segment and of the fifth segment but half as long as that of the third segment (1–1–3–2–1½).

This species feeds on *Amarantus spinosus* Linn.

[5] The excrescent tracheæ may prove to be very valid specific characters.

METRIONA TRIVITTATA Fabr. (Pl. VI, fig. 4).

Metriona trivittata Fabr., *Syst. Eleuth.* (1801), 1, 397.

Egg: The egg-case of *M. trivittata* Fabr. (Pl. V, fig. 4) is somewhat similar to that of *P. sinuata* Oliv., but more perfect in its structure. It is laid on the upper or under side of the leaf and always contains a single egg. The egg itself is inclosed within a very thin primary case and the latter is placed under a remarkably perfect, roof-like cover fastened to the leaf. This cover is thin and has two nearly parallel, longitudinal carinæ, which are somewhat excurved at one end, but run together at the other end where they are bent and erect. The area between the carinæ has a semicircular impression, but the area outside of this is sloping. (Pl. V, fig. 5, diagram of cross-section.) Numerous regular, fine striæ are visible. The egg of this species is always free from any excremental covering.[6] The color of the egg-case is a very pale green.

Larva: Shortly after hatching and before feeding, the young larva expresses a kind of glutinous substance which it pastes with its long evaginating anus upon each one of the long, subanal spines in the shape of a tiny drop. Later it places the particles of its excreta upon these spots of glue, so that about twelve hours after hatching, a union is effected between the particles on the two subanal spines. The larva (Pl. V, fig. 6) disposes of its excrement in this manner only during the period from hatching to the first molt, that is, in building up a cross-bar between the two subanal spines.

The larva of *M. trivittata* Fabr. (Pl. V, fig. 7) is very flat and of a uniform green color, only the spines are somewhat lighter, the stigmata being white. The color of the larva corresponds exactly with that of the leaves of its food plant (*Ipomœa triloba* L.). The larva has thirty-two marginal and two subanal spines; the former, with the exception of the inner slightly curved ones on the first pairs, are straight. the shortest being situated on the third, fourth, fifth and sixth, the longest on the seventh abdominal segment. All of these spines are beset laterally with minute spinules. The forked subanal spines of this larva are very long, in fact even in the full-grown ones at least half as long as the whole body and two of the exuviæ are transfixed by the above-mentioned spines. In this species the exuviæ are fastened to each other in a manner similar to that in *A. miliaris* Fabr. The larvæ of *M. trivittata* Fabr. are found mostly on the upper sides of the leaves and carry their exuviæ behind them, lying flat to the leaf, but when disturbed they bend the mass up over the dorsum as a protecting shield for the body. All larval skins remain on the pupa.

[6] Observation of about 200 eggs.

LIFE HISTORY.

	1907.		1907.
Egg laid	November 17	Third molt	December 5
Egg hatched	November 27	Fourth molt	December 9
First molt	November 30	Pupated	December 15
Second molt	December 2	Adult emerged	December 19

Pupa (Pl. V, fig. 8): Exterior line of the pronotum oval and with a marginal row of spinules of which two pairs, anteriorly, are very prominent and twice as long as the others. Lateral margins of the first to sixth abdominal segments lamellated, semitransparent and surrounded by a row of spinules of which those at the point are longer than the others, the lamellation decreasing in size toward the sixth segment. Stigmata white, tracheae slightly excrescent, but very long on the fourth segment. The pupa is of the same color as the larva. This species is the most common of those described in this paper and is found during the entire year.

LACOPTERA PHILIPPINENSIS Blanch. (Pl. VI, fig. 3).

Lacoptera philippinensis Blanch., *Voy. Pole Sud*, (1853), 4, 321, plate 18, fig. 14.

Egg: The egg (Pl. V, fig. 1) is in a thin primary case; later, under a perfect cover, fastened to the leaf. There is always a large quantity of excrement present on the central part of the cover. Its margins show numerous, regular impressions. The egg is laid on the upper and under sides of the leaves and the egg case contains only a single egg. This species differs in this respect from *Lacoptera excavata* Bohem., as Muir [7] observed that the eggs of this species were laid with from two to four in each case.

Larva: The young larva of *L. philippinensis* Blanch. is yellowish, later it turns brown, the chitinous plates on the prothoracic segment being still darker. The larva (Pl. V, fig. 2) has eight [8] spines on the prothoracic segment, two forked pairs in front being slightly curved. All the spines are irregular in shape, not straight, and have minute spinules, even the very long, subanal ones having some toward the base. This larva also uses its excrement in forming a solid flat, roughly triangular shield or cover. As in *L. excavata* Bohem., at each molt the old skin is worked into the shield, yet is not covered entirely with excrement, skins of the heads and feet of different molts still remaining visible. The larva is found most frequently on the upper side of the leaf.

[7] *loc. cit.*, p. 8.

[8] The larva of *L. philippinensis* Blanch. differs also in this respect from *L. excavata* Bohem. as the latter species has only six spines on the prothoracic segment (Muir, *loc. cit.* Pl. V, fig. 27a).

LIFE HISTORY.

	1907.		1907.
Egg laid	November 11	Third molt	November 25
Egg hatched	November 17	Fourth molt	November 29
First molt	November 21	Pupated	December 7
Second molt	November 23	Adult emerged	December 15

Pupa: The general color of the pupa of *L. philippinensis* Blanch. (Pl. V, fig. 3) is ochraceous-brown, with a few dark-brown markings around the stigmata and on the discal areas of the segments. The pronotum has a slight incision in front and a marginal row of spinules, of which the two pairs in front are larger and more strongly developed than the others. A triangular medial area is somewhat raised, it slopes toward the outer margin, ending in two impressions toward the inner margin; the outer margin of the first to the fifth abdominal segments is lamellated, semitransparent and with a marginal row of spinules. Stigmata brown, trachæ excrescent, more so on the fourth and fifth abdominal segments. *L. philippinensis* Blanch. feeds on *Ipomœa triloba* L.

SUMMARY.

The question of the purpose of the peculiar excremental coverings, filaments or armatures arises in the study of the different stages of *Cassididæ*. Several authors have expressed their opinions. Weise mentions the excremental coverings, etc., as a shelter against draught, and Candéze considers them as a protection against enemies. I have noted the following facts bearing upon the above-mentioned theories, during the observation of a few hundred specimens of the different species: the eggs of the different species are found on the upper and under surfaces of the leaves, with the exception of those of one species (*C. picifrons* Weise), in which instance they are encountered only on the under surface; with or without excremental coverings (in two species entirely without such covering, namely, *A miliaris* Fabr. and *M. trivittata* Fabr.). It seems to me that the placing of the egg on the lower surface of the leaf would be the first protection against draft,[9] the covering being a secondary one. Again, the excremental covering would be a protection against parasites. Of all the eggs which I observed, only one, *L. philippinensis* Blanch., was infested by a parasite (*Chalcididæ*). The larva of *P. sinuata* Oliv., as well as those of *P. schultzei* Weise and *L. philippinensis* Blanch., live mostly on the upper surface of the leaf and are concealed under the excremental shield when resting, although when they move about they carry the cover in a position nearly perpendicular to the body. If molested by another insect, or by the shaking of the leaf, they bend the shield over themselves as a protection. The solid part of the shield entirely covers the abdominal segments dorsally, for

[9] Small pieces of leaves with the eggs attached, were cut out and placed in glass dishes with covers. In the course of a day, the small fragments of leaves were perfectly dry and brittle, although the eggs hatched just the same.

the reason that the skin in this place is not as hard as on the thoracic segments, which are protected by chitinous plates. The larvæ of *A. miliaris* Fabr., which live closely together in groups, act in a slightly different way. If one is disturbed, it begins to flick with its old skins. The larvæ sitting next to it, or even the whole group, take up the motion and in unison they strive to frighten the enemy away. I have noticed this action repeatedly. The larva of *M. trivittata* Fabr., when resting, carries its old skins behind, lying flat on the leaf, but when it is moving around, they are perpendicular to the body. It also uses its old skins in a way similar to *A. miliaris* Fabr. I have applied the following test many times. The larva, when molested with a hair, tries to touch the latter with the old skins, with the intention evidently of removing the annoying object. The pupæ of *Prioptera* and *Aspidomorpha miliaris* Fabr. do not retain the old skins, but only the last one of the larval stage by which they are fastened to the leaf. The newly transformed pupæ are extremely sensitive and when touched give several sharp flicks. During the later period of the pupal stage, they do not react as easily, the reason probably being that during the early portion of this period the skin is quite soft, but during the latter part hard enough to give sufficient protection against parasites even without the old skins or shields which are retained in the other species.

The infection by parasites probably takes place during the periods of the different molts, as in those stages the larvæ are quite helpless. The larvæ of *M. trivittata* Fabr. were often infested by a fly (*Muscidae Trachinae*), the larva of which, after becoming full grown, builds its puparium inside of the larval skin of *M. trivittata* Fabr. Pupæ of *A. miliaris* Fabr. were often infested by a small *Chalcididae*,[10] as many as 150 emerging from one pupæ.

In consideration of facts concerning the usefulness of all excremental coverings, or armatures, etc., observed on the different species mentioned in this paper, the theory of Candéze seems to me credible, and I believe that the curious structures are used principally as a protection against *parasitic enemies.*

NOTE.—After my paper was in type I happened to see the following paper: "On the egg-cases and early stages of some South China Cassididæ" by J. C. Kershaw and Frederick Muir in *Trans. Ent. Soc. Lond.* (1907) p. 249. It is worth mentioning that *C. picifrons* Weise and *L. philippinensis* Blanch. differ also in their egg-laying habits from *C. obtusata* Bohem. and *L. chinensis* Fabr., as the latter species lay more than one egg under the egg cover. With reference to the summarizing sentence of Kershaw and Muir, I still believe that protection against parasitic enemies is the "*raison d'être*" for the development of the egg-cases and larval appendages.

[10] Mr. Banks and myself observed the act of copulation on these Hymenoptera. The adult parasites make a few tiny holes in the pupal skin of the host. The males, after emerging, stand guard around each of the holes thus made, and as soon as a female comes out, the act of copulation, which is extremely short, takes place.

ILLUSTRATIONS.

PLATE I.

FIG. 1. Egg of *Prioptera sinuata* Oliv. with the upper egg-case cover removed, × 11.
2. Egg-case of *Prioptera sinuata* Oliv., × 9.
3. Larva of *Prioptera sinuata* Oliv., resting position, × 5.
4. Larva of *Prioptera sinuata* Oliv., with the excremental shield bent backward, × 5.
5. Pupa of *Prioptera sinuata* Oliv., × 5.
6. Egg-case of *Prioptera schultzei* Weise, × 10.
7. Larva of *Prioptera schultzei* Weise, × 5.
8. Pupa of *Prioptera schultzei* Weise, × 5.

PLATE II.

Groups of larvæ of *Aspidomorpha miliaris* Fabr., natural size.

PLATE III.

FIG. 1. Egg-case of *Aspidomorpha miliaris* Fabr. Lateral section, × 5.
2. Larva of *Aspidomorpha miliaris* Fabr. after fourth molt, × 5.
3. Larva of *Aspidomorpha miliaris* Fabr. shortly before pupation, × 5.
4. Pupa of *Aspidomorpha miliaris* Fabr., × 5.
5. Egg-case of *Cassida picifrons* Weise, × 10.
6. Larva of *Cassida picifrons* Weise, × 8.
7. Pupa of *Cassida picifrons* Weise, × 12.

PLATE IV.

Group of pupæ of *Aspidomorpha miliaris* Fabr., natural size.

PLATE V.

FIG. 1. Egg-case of *Laccoptera philippinensis* Bohem., × 10.
2. Larva of *Laccoptera philippinensis* Bohem., × 5.
3. Pupa of *Laccoptera philippinensis* Bohem., × 5.
4. Egg-case of *Metriona trivittata* Fabr., × 10.
5. Section of the egg-case of *Metriona trivittata* Fabr.
6. Larva of *Metriona trivittata* Fabr. after first molt, × 10.
7. Larva of *Metriona trivittata* Fabr. after fourth molt, × 5.
8. Pupa of *Metriona trivittata* Fabr., × 5.

PLATE VI.

FIG. 1. *Prioptera schultzei* Weise, × 3.
2. *Prioptera sinuata* Oliv., × 3.
3. *Laccoptera philippinensis* Bohem., × 3.
4. *Metriona trivittata* Fabr., × 3.
5. *Cassida picifrons* Weise, × 3.
6. *Aspidomorpha miliaris* Fabr., × 3.
7, 8, and 9. Variations of *Aspidomorpha miliaris* Fabr., × 3.

FIG. 3.

FIG. 2.

FIG. 1.

FIG. 4.

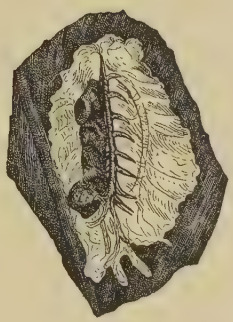

FIG. 6.

FIG. 5.

FIG. 7.

FIG. 8.

PLATE I.

PLATE II.

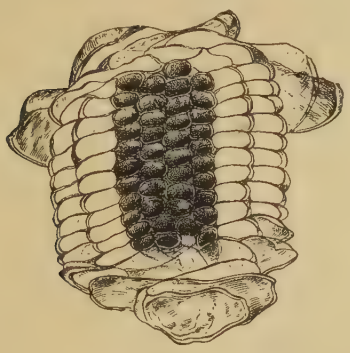

FIG. 1.

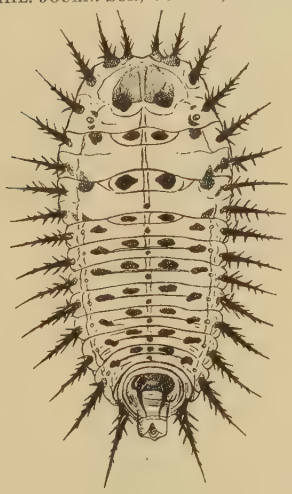

FIG. 3.

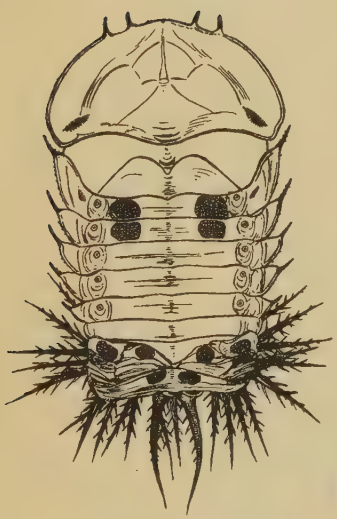

FIG. 4.

FIG. 5.

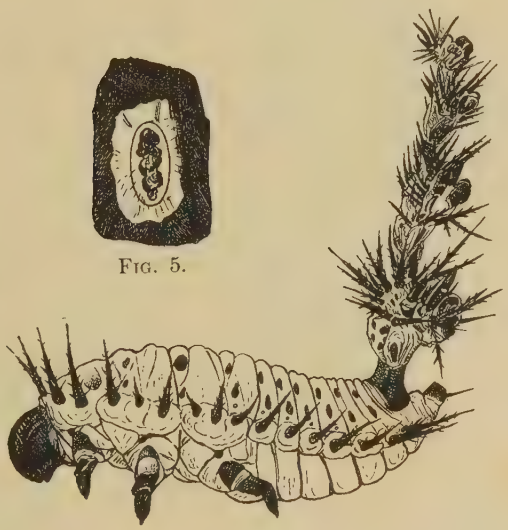

FIG. 2.

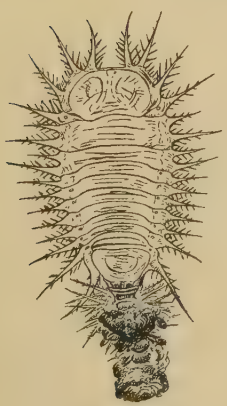

FIG. 6.

FIG. 7.

PLATE III.

PLATE IV.

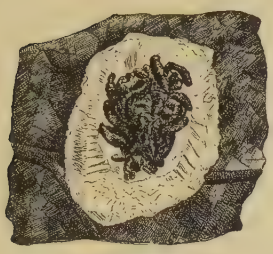

FIG. 1.

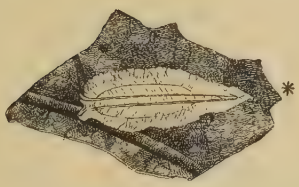

FIG. 4.

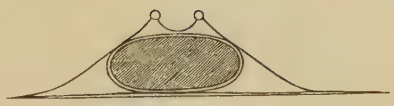

FIG. 5.

FIG. 2.

FIG. 6.

FIG. 3.

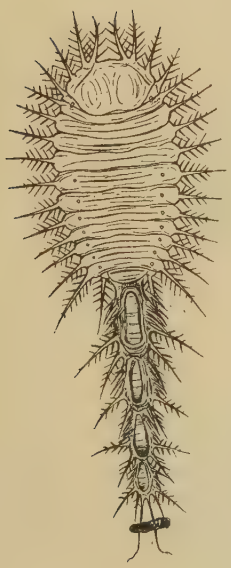

FIG. 7.

FIG. 8.

PLATE V.

FIG. 1.

FIG. 2

FIG. 3.

FIG. 4.

FIG. 5.

FIG. 6.

FIG. 7.

FIG. 8.

FIG. 9.

PLATE VI.

PROTHYMA SCHULTZEI, A NEW SPECIES OF PHILIPPINE CICINDELIDÆ.

By Walther Horn.
(*Berlin, Germany.*)

♂ *Pr. lucidicollis* Chd. parum affinis; multo major; fronte prope antennarum insertionem viridi et inter oculos maculis 2 parvis discolidalibus cyaneis aut viridibus ornata, ceteris frontis partibus et vertice et pronoto (hujus totis marginibus lateralibus et solum modo hinc inde sulcis transversis viridi-cyanescentibus) cupro-aeneo- splendentibus, elytris atro-cyaneo-purpurascentibus nitentibus, ad marginem paullo clarioribus (parte humerali marginali interdum cyaneo-viridescente); labro flavo, dente juxta-mediano acuto, mediano ceterisque 4 obtusis aut deficientibus; fronte magis excavata inter oculos, paullulum angustiore (proportione magnitudinis totius corporis!), strigis juxta-orbitalibus grossioribus; prothorace coidenter longiore, parallelo aut ante basim perparum dilatato; elytris multo longioribus, parte suturali et apicale planioribus; maculis 3 albescentibus marginalibus; humerali sat magna ut in illa, 2 cereris paullo magis a margine distantibus, media paullulum obliqua (intus et posticem versus descendente). Corpore subtus ceruleo et cyaneo, episternis interdum hinc inde violaceis; pedibus (femorum parte media aeneo-metallica, basi plus minusve testacea) et 4 primis antennarum articulis (3° et 4° interdum plus minusve testaceis), nigro-cyaneo-purpureis; palporum articulo ultimo nigricante, coxis 4 anterioribus (posticis metallicis cum apice parvo testaceo), trochanteribus flavis. Coxis posticis in disco sparsim punctato-setosis. Long. 12–14 mm.

2 ♂ ♂, Romblon Insula (Philippinae), a Dom. R. C. McGregor collecta.

Typus No. 2049 in collectione "Bureau of Science," Manilensis.

1 ♀ differt a 2 ♂ ♂ labro brunnescente, marginibus lateralibus dilutioribus, dente mediano magno ornato; pronoto ante basim perparum angustato; elytrorum apice paullo brevius rotundato paulloque minus applanato; femoribus rufo-testaceis, genis anguste metallicis; tibiis proximaliter et penultimo palporum maxillarium articulo brunnescentibus.

1 ♀ Sibuyan Insula (Philippinae), a Dom. R. C. McGregor collecta.

Typus No. 1965 in collectione "Bureau of Science," Manilensis.

There is but little resemblance at first sight, between this bright species and the little *Pr. lucidicollis* Chd., although the characters given above seem not to be so striking (we must remember that the whole genus belongs to those that are exceedingly poor in good distinctive characters!). The beautiful, red-golden color of the front and pronotum contrasts very well with the almost black-purple (shining) elytra. The large size and parallel form are equally remarkable. The fine sculpture of the front (rougher near the eyes), is longitudinal, that of the vertex and pronotum transverse, the median line of the latter is very slightly impressed, the sulcus on the base (between the free posterior margin and the posterior transverse strangulation) deep and well marked throughout. The punctures of the elytra are separated each from the other, only on the posterior third (near the suture from the middle) are they slightly confluent. Five slight, indistinct impressions are to be seen on each elytron: running down a short distance from the interior margin of the humeral spot; at the first quarter, nearer the suture than the lateral margin; anterior to the median and apical spots; and just before the apex.

The penultimate joint of the labial palpus is slightly thickened. The ♀ seems to have the prothorax slightly narrowed towards the posterior strangulation.

NOTES ON A COLLECTION OF BIRDS FROM SIQUIJOR, PHILIPPINE ISLANDS.

By Richard C. McGregor.

(*From the Zoölogical Section, Biological Laboratory, Bureau of Science, Manila, P. I.*)

Siquijor is a coral-rock island with an area of about 235 square kilometers; it lies in close proximity to the large Island of Negros, there being little more than 19 kilometers of water intervening between the two. As clearly explained by Worcester,[1] its birds must have come into the island during comparatively recent times and three of these have developed into well-marked representative species, namely, *Dicæum besti, Loriculus siquijorensis,* and *Iole siquijorensis.* It is also noteworthy that none of the *Megapodiidæ, Turnicidæ, Bucerotidæ, Picidæ, Dicruridæ, Sittidæ, Paridæ,* or *Timeliidæ* are known from Siquijor, although each of these families has representatives in adjacent islands.

The list of species here recorded is derived from a collection made in Siquijor by Mr. Andres Celestino, assistant collector, Bureau of Science, in September, 1907, and in April and May, 1908. There are here listed nine species not previously known from Siquijor which with the 87 species given by Worcester and Bourns [2] make a total of 96, and there seems to be little probability of this number being greatly increased.

LIST OF SPECIES NOW RECORDED FROM SIQUIJOR FOR THE FIRST TIME.

Excalfactoria lineata.
Calœnas nicobarica.
Actitis hypoleucos.
Bubulcus coromandus.
Falco ernesti.
Cacomantis merulinus.
Acanthopneuste borealis.
Motacilla melanope.
Anthus gustavi.

[1] *Proc. U. S. Nat. Mus.* Wash. (1898), **20**, 581.
[2] *Proc. U. S. Nat. Mus.* Wash. (1898), **20**, 564.

LIST OF SPECIES COLLECTED.[3]

PHASIANIDÆ.

Excalfactoria lineata (Scopoli).

One male and one female, both in adult plumage, were collected. Siquijor is a new locality for this species where it is known as *"bun-tóg."*

Gallus gallus (Linnæus).

One jungle cock was collected.

TRERONIDÆ.

Osmotreron vernans (Linnæus).

Two adult males of this handsome wood-dove. The eggs are pure white: two collected April 11, 1908, measure, 30 by 22.6 and 31.6 by 22.4. Two eggs collected at a somewhat later date measure, 27.5 by 21.2 and 27.3 by 21.2. The nest of this dove is a thin platform of coarse rootlets and tendrils with a few larger sticks as a foundation. Two or three dead leaves are scattered among the rootlets. The greatest diameter of the nest collected is about 200 millimeters and the greatest outside depth less than 30 mm.

Osmotreron axillaris (Bonaparte).

Four specimens in fine plumage have the wings slightly longer than do specimens from more northern islands, but the colors are not different. An egg taken from the oviduct of a female on April 15, 1908, measured 30 by 23.7.

Phapitreron albifrons McGregor.

Two specimens of the genus *Phapitreron* can not be distinguished from *P. albifrons* of Bohol.

Muscadivores chalybura (Bonaparte).

One male and one female of the imperial fruit pigeon are of this common variety of *M. ænea.*

Myristicivora bicolor (Scopoli).

One specimen of the nutmeg pigeon.

PERISTERIDÆ.

Streptopelia dussumieri (Temminck).

Two specimens of this common turtle dove.

Chalcophaps indica (Linnæus).

One specimen.

[3] The metric system is used in all measurements here recorded. The vernacular names given under various species were found in use among the residents of the island and were collected by Mr. Celestino.

Calœnas nicobarica (Linnæus).

One female specimen and two live examples of the handsome Nicobar pigeon were secured in Siquijor, a new locality for this widely distributed species.

RALLIDÆ.

Hypotænidia torquata (Linnæus).

One female in fine, adult plumage; the local name is *"tic-líng."*

Amaurornis phœnicura (Forster).

One full-plumaged male and one slightly immature male; in the latter the breast is somewhat mottled with slaty gray. Name in Siquijor, *"qui-yaó."*

LARIDÆ.

Sterna boreotis (Bangs).

One male was taken on September 7, 1907.

CHARADRIIDÆ.

Squatarola squatarola (Linnæus).

A male in intermediate plumage was taken September 6, 1907.

Charadrius fulvus (Gmelin).

A male in intermediate plumage was taken September 6, 1907.

Actitis hypoleucos (Linnæus).

A female was collected in September, 1907. Siquijor is thus added to the long list of islands from which this common sandpiper is known.

ARDEIDÆ.

Nycticorax manillensis Vigors.

A fragment, consisting of head and neck, is identified as belonging to the Philippine night-heron.

Bubulcus coromandus (Boddaert).

A male of the cattle egret in breeding plumage. This species is called *"ta-la-bóng"* in Siquijor. Not previously noted from that island.

ANATIDÆ.

Dendrocygna arcuata (Horsfield).

A male of this common tree-duck.

FALCONIDÆ.

Haliastur intermedius Gurney.

This common buzzard is represented by the tail of an immature individual. It is known in Siquijor as *"ba-nóg."*

Falco ernesti Sharpe.

A fine male falcon is identified as being of this rare species. Although in somewhat immature plumage, a number of feathers on flanks and

thighs, particularly on the latter, show the characteristic smoky gray color and the close-set, black bands. The measurements of this specimen follow: Wing, 300 millimeters; tail, 160; bill from front of cere, 21; tarsus, 45. The name of this species in Siquijor is *"a-na--nang-quíl."*

BUBONIDÆ.

Ninox philippensis Bonaparte.

The single male obtained in Siquijor does not differ from specimens taken in Luzon.

CACATUIDÆ.

Cacatua hæmaturopygia (P. L. S. Müller).

Two males of the common Philippine cockatoo.

PSITTACIDÆ.

Tanygnathus lucionensis (Linnæus).

Two males collected.

Loriculus siquijorensis Steere.

This distinct species is similar to *L. mindorensis* but the red patch on the forehead ends in a point instead of ending squarely and the red patch on the breast covers about one-half the area that it does in *L. mindorensis*. The native name is *"co-lan-sí."*

ALCEDINIDÆ.

Alcedo bengalensis Brisson.

One specimen.

Halcyon gularis (Kuhl).

One male specimen of this common kingfisher; it has two names in Siquijor, *"uak-bá-ta"* and *"ma-nák-sak."*

Halcyon chloris (Boddaert).

One slightly immature female.

MEROPIDÆ.

Merops philippinus Linnæus.

Two specimens.

CYPSELIDÆ.

Collocalia troglodytes Gray.

One male specimen; known as *"sai-áo."*

CUCULIDÆ.

Cacomantis merulinus (Scopoli).

This common cuckoo is called *"yoi-hó"* in Siquijor; this is the first record of its occurrence in that island.

Eudynamis mindanensis (Linnæus).

The male collected shows no peculiarities. The local name is *"cu-la-haó."*

Centropus viridis (Scopoli).

The local name is *"cuk-cuk."* The fresh eggs, taken on April 7, 1908, measure 30.6 by 25.6 and 31.1 by 25.7. They are pure white. The nest was composed of sticks and had a small entrance in one side, the entire top being covered. The nest was built in a small bush at the height of a man's head.

PITTIDÆ.

Pitta atricapilla Lesson.

Two specimens were obtained of this widely distributed ant-thrush. Its local name is *"uao-há."*

HIRUNDINIDÆ.

Hirundo javanica Sparrmann.

One specimen.

MUSCICAPIDÆ.

Hemichelidon griseisticta (Swinhoe).

One male specimen.

Cyornis philippinensis Sharpe.

One specimen; this species is known as *"ca-man-ti-gon."*

Hypothymis occipitalis (Vigors).

One female.

Rhipidura nigritorquis Vigors.

This common flycatcher is called *"ba-li-á-la"* in Siquijor.

CAMPOPHAGIDÆ.

Lalage niger (Forster).

Name in Siquijor *"bu-ga-ung-ón."*

PYCNONOTIDÆ.

Iole siquijorensis Steere.

This interesting species appears to be fairly abundant in Siquijor where it is known as *"tig-ba-ya."* Its nearest relatives are *I. monticola* of Cebu and *I. cinereiceps* of Tablas. It differs from either of these species in having the top of head seal-brown without ashy gray tips to the feathers.

TURDIDÆ.

Petrophila manilla Boddaert.

One female specimen; known as *"yú-ta yú-ta."*

Copsychus mindanensis (Gmelin).

One male specimen; called *"a-ni-ní-hol."*

Pratincola caprata (Linnæus).

One female.

SYLVIIDÆ.

Cisticola exilis (Vigors and Horsfield).

This common grass warbler is called *"pi-rót"* in Siquijor.

Acanthopneuste borealis (Blasius).

This migratory warbler seems to have been unnoticed by previous collectors; two specimens were taken by Celestino.

ARTAMIDÆ.

Artamus leucorynchus (Linnæus).

One specimen.

LANIIDÆ.

Cephalophoneus nasutus (Scopoli).

Three specimens in good plumage.

Otomela lucionensis (Linnæus).

One specimen in immature plumage. The name *"ti-ba-lás"* is used for both *Otomela* and *Cephalophoneus.*

Hyloterpe apoensis Mearns.

A male from Siquijor agrees with numerous specimens of *Hyloterpe* from Bohol and these are best identified with *H. apoensis,* at the same time it may be noted that the single male of typical *apoensis* before me has a slightly smaller bill than any of the Bohol specimens or the single male from Siquijor.

ZOSTEROPIDÆ.

Zosterops siquijorensis Bourns and Worcester.

Numerous specimens; known as *"lu-lai-og".* This bird is closely related to the species found in Basilan and Bohol but in the Siquijor species the sides of the breast are much lighter gray.

DICÆIDÆ.

Dicæum besti Steere.

A fair series was obtained of this near relative of *D. cinereigulare.* Local name *"pis-pis".*

Dicæum pygmæum (Kittlitz).

One specimen of this plain flower-pecker.

NECTARINIIDÆ.

Cinnyris sperata (Linnæus).

Two adult males.

Cinnyris jugularis (Linnæus).

One female.

MOTACILLIDÆ.

Motacilla melanope Pallas.

Two females in rather poor plumage serve to add one more to the islands from which this species is known. Its name in Siquijor is *"a-na-nok-yód"*.

Anthus rufulus Vieillot.

Known in Siquijor as *"a-la-lak-síng"*.

Anthus gustavi Swinhoe.

One specimen; not previously known from Siquijor.

ORIOLIDÆ.

Oriolus chinensis Linnæus.

One specimen of this large oriole.

STURNIDÆ.

Sarcops melanonotus Grant.

The two bald starlings collected in Siquijor certainly approach this recently named race.

Lamprocorax panayensis (Scopoli).

Two specimens.

CORVIDÆ.

Corone philippina (Bonaparte).

The Philippine crow concludes the list of species from Siquijor.

SOME NECESSARY CHANGES IN THE NAMES OF PHILIPPINE BIRDS.

By Richard C. McGregor.

(From the Zoölogical Section, Biological Laboratory, Bureau of Science, Manila, P. I.)

Aluco longimembris (Jerdon).

Strix candida (not of Latham) Tickell, Jour. As. Soc. Bengal (1833), **2**, 572.
Strix longimembris Jerdon, Madras Journ. (1839), **10**, 86.

Dr. Charles W. Richmond writes me that the name usually applied to the grass owl is preoccupied by *Strix candida* Latham, Suppl. Ind. Orn. (1801), p. xiv which is a synonym for the snowy owl. The next available name is the one used by Jerdon.

The generic name *Strix* Linnæus is replaced by *Aluco* Flemng. *Cf.* Auk (1908), **25**, 370.

Megalurus tweeddalei new name.

Megalurus ruficeps (not of Sykes) Tweeddale, Ann. & Mag. Nat. Hist. (1877), **20**, 94; Proc. Zoöl. Soc. (1877), 695, pl. 72.

The name *Megalurus ? ruficeps* is used by Sykes for an Indian species in Proc. Zoöl. Soc. (1832), 91. As this invalidates the use of this name for the Philippine species, the latter, figured and described by Lord Tweeddale, may be known as *Megalurus tweeddalei.*

Zosterops boholensis new name.

Zosterops læta (not of De Vis) McGregor, Phil. Jour. Sci. (1907), **2**, Sec. A, 329.

The name under which the silver-eye of Bohol was described had been used before for a species from New Guinea, see *Zosterops læta* De Vis, Ibis (1897), 385. The Bohol species may therefore be named for the island which it inhabits.

Cinnyris henkei Meyer.

Cinnyris henkei Meyer, Zeitschr. für Ges. Orn. (1884), 207, pl. 7.
Cinnyris whiteheadi Grant, Bull. Brit. Orn. Club (1894), **2**, 1; Ibis (1894), 514, pl. 14, fig. 1.

The black-backed sun-bird, described and figured by Grant as *Cinnyris whiteheadi,* finds an earlier name in *Cinnyris henkei* as indicated by Dubois, Syn. Av. (1902), 699.

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PHILIPPINE ORNITHOLOGICAL LITERATURE, I.

By Richard C. McGregor.

(From the Zoölogical Division, Biological Laboratory, Bureau of Science, Manila, P. I.)

This is the first of a series of papers having for its final object a complete bibliography of Philippine ornithology. Primarily, however, these papers are intended to indicate exactly what works are available in Manila and to explain the bearing of each paper or volume on the study of Philippine birds. Particular effort will be made to record, promptly, recent and current publications which deal specifically with the Philippine ornis, but older works and those of a more general character will be included. Each installment of Philippine ornithological literature will consist of about fifty titles and will be issued from time to time as material becomes available.

Gadow, H.: Paridæ and Laniidæ (titmice and shrikes), and Certhiomorphæ (creepers and nuthatches). Cat. Birds Brit. Mus. London (1883), **8**, 1–386, pls. 1–9.

This essential volume contains synonymy, keys, and descriptions of all species of titmice, shrikes, and nuthatches known at date of publication. No Philippine species is figured.

Gadow, H.: Nectariniidæ. Cat. Birds Brit. Mus. London (1884), **9**, 1–126, pl. 1.

This essential volume contains synonymy and descriptions of all species of sun-birds known at the date of publication. No Philippine species is figured.

Grant, W. R. O.: Steganopodes (cormorants, gannets, frigate-birds, tropic-birds, and pelicans). Pygopodes (divers and grebes). Cat. Birds Brit. Mus. London (1898), **26**, 329–558, pls. 5a–8.

This includes synonymy, keys, and descriptions of all Philippine species in the Steganopodes and Pygopodes known at date of publication. No Philippine species is figured. This work is essential.

Grant, W. R. O.: Bucerotes and Trogones. Cat. Birds Brit. Mus. London (1892), **17**, 347–497, pls. 13–17.

Synonymy, keys, and descriptions of all the known trogons and hornbills. No plates of Philippine species. *Gymnolæmus*, new genus for *Anthracoceros lemprieri* Sharpe. This work is essential.

Grant, W. R. O.: Game birds (Pterocletes, Gallinæ, Opisthocomi, Hemipodii. Cat. Birds Brit. Mus. London (1893), **22**, 1–588, pls. 1–8.

Descriptions and synonymy of all Philippine species of *Megapodiidæ*, *Phasianidæ*, and *Turnicidæ* are included, but no plates of Philippine species.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part I. Mount Arayat, Central Luzon. *Ibis* (1894), 406–411.

This is the first of the series of important papers by Grant on the collections made by John Whitehead; 40 species are listed.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part II. The highlands of north Luzon, 5,000 feet. *Ibis* (1894), 501–522, pls. 14 and 15.

This is an important paper on a collection of 94 species from (vicinity of Trinidad?), Benguet Province. Two new species, *Muscicapula luzoniensis* and *Cittia seebohmi*, are described and the following 17 species, first characterized in Bull. Brit. Orn. Club, are more fully described: *Scops longicornis*, *Oriolus albiloris*, *Stoparola nigrimentalis*, *Merula thomassoni* Seebohm, *Chimarrhornis bicolor*, *Zosterornis whiteheadi*, *Hyloterpe albiventris*, *Lanius validirostris*, *Dendrophila mesoleuca*, *Æthopyga flavipectus*, *Eudrepanis jefferyi*, *Cinnyris whiteheadi*, *Cinnyris obscurior*, *Dicæum luzoniense*, *Dicæum obscurum*, *Loxia luzoniensis*, and *Chlorura brunneiventris*. Two species, *Emberiza pusilla* and *E. sulfurata*, are recorded as new to the Philippine avifauna. *Cinnyris whiteheadi*, *Stoparola nigrimentalis*, *Zosterornis whiteheadi*, and *Chimarrhornis bicolor* are figured on the two plates.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part III. The mountains of the Province of Isabela, in the extreme northeast of Luzon. *Ibis* (1895), 106–117, pls. 4 and 5.

This important paper lists 30 species from Isabela Province and contains additional notes on *Oriolus isabellæ* and *O. albiloris*, which were previously described in Bull. Brit. Orn. Club. *Zosterornis striatus* is described as new; *Munia formosana* and *Cotile sinensis* are added to the Philippine list. *Zosterornis striatus*, *Dendrophila mesoleuca*, *Æthopyga flavipectus*, and *Eudrepanis jefferyi* are the subjects of the two plates.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part IV. The Province of Albay, southeast Luzon, and the adjacent Island of Catanduanes. *Ibis* (1895), 249–267.

This paper lists 46 (?) species from Albay Province and 48 species from Catanduanes. Additional descriptions and notes are given of *Callaeops periopthalmica*, *Zosterops luzonica*, and *Cinnyris excellens* which were previously described in Bull. Brit. Orn. Club. There are extended notes on variation in *Sarcops calvus* and *Prioniturus discurus*. *Carpophaga poliocephala* is recorded from Luzon for the first time and *Emberiza spodocephala* from Catanduanes is recorded as new to the Philippines.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part V. The highlands of the Province of Lepanto, north Luzon. *Ibis* (1895), 433–472, pls. 12–14.

Notes on 110 species. Additional descriptions of *Scops longicornis*, *Scops whiteheadi*, *Rhinomyias insignis*, *Lusciniola seebohmi*, *Cettia seebohmi*, *Brachypteryx poliogyna*, *Pseudotharrhaleus caudatus*, *Zosterops aureiloris*, *Pyrrhula leucogenis*, *Batrachostomus microrhynchus*, and *Prioniturus monta-*

nus, which were previously described in Bull. Brit. Orn. Club. *Collocalia whiteheadi* is described as new; *Cinnyris obscurior* is rejected as being based on *C. jugularis* in worn plumage; *Pitta kochi* and *Ptilopus marchei* and the females of *Dicæum xanthopygium* and *Cittocincla luzoniensis* are fully described. Notes on plumages of *Macropygia tenuirostris; Falco severus* added to the Luzon list; *Cerchneis tinnunculus* and *Collocalia linchi* added to the Philippine list.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part VI. The vicinity of Cape Engaño, northeast Luzon, Manila Bay, and Fuga Island, Babuyan Group. *Ibis*, (1896), 101–128, pl. 3.

Additional notes and descriptions of *Siphia enganensis, Hypsipetes fugensis, Orthotomus chloronotus*, and *Zosterornis dennistouni* all previously described in Bull. Brit. Orn. Club. Critical notes on the plumages of *Accipiter gularis*. Young male of *Parus semilarvatus* described. First Luzon record of *Fregata minor*. Notes on the *Eudynanis* of Fuga. *Orthotomus chloronotus* and *Zosterornis dennistouni* are figured on the plate.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part VII. The highlands of Mindoro. *Ibis* (1896), 457–477, pl. 11.

A list of 52 species with numerous notes. *Ninox mindorensis* and *Turdus mindorensis*, new species. *Carpophaga mindorensis* Whitehead, is redescribed and figured. *Locustella ochotensis* is recorded, for the second time, from the Philippines. Notes on *Scops* sp. inc., later described by Whitehead as *S. mindorensis*. A useful key to the Philippine species of *Iyngipicus* is given.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part VIII. The highlands of Negros. *Ibis* (1896), 525–565.

A list of 86 species; *Artamides cebuensis, Turdus nigrorum, Brachypteryx brunneiceps*, and *Cittocincla nigrorum*, new species. Keys to the Philippine species of *Oriolus, Rhinomyias, Artamides*, and *Edoliisoma*. *Oriolus basilanicus*, new name. First Negros records for *Tanygnathus everetti* and *Surniculus velutinus;* first Philippine record for *Cuculus micropterus*. *Iole guimarasensis* is considered to be distinct from *Iole philippensis; Munia brunneiceps* is considered to be the worn plumage of *M. jagori*. Notes on the plumages of *Spilornis panayensis* and *Falco ernesti*.

Grant, W. R. O.: On the birds of the Philippine Islands.—Part IX. The Islands of Samar and Leyte. *Ibis* (1897), 209–250, pls. 5 and 6.

A list of 93 species with numerous notes. Additional notes on *Pithecophaga jefferyi, Rhabdornis minor*, and *Rhabdornis inornatus*, which were previously described in Bull. Brit. Orn. Club. *Microhierax meridionalis* is described as new; notes on *Ceyx;* female of *Microstictus fuliginosus* described. Keys to the Philippine species of *Orthotomus, Macronus, Zosterornis*, and *Rhabdornis*. *Poliolophus basilanicus* is considered not distinct from *P. urostictus*. Eight species new to Samar and 14 species new to Leyte.

Grant, W. R. O.: On the birds collected by Mr. Walter Goodfellow on the volcano of Apo and in its vicinity, in southeast Mindanao, Philippine Islands. *Ibis* (1906), 465–505, pls. 18 and 19.

A list of 124 species with many critical and field notes. *Hypocryptadius cinnamomeus, Rhinomyias goodfellowi*, and *Pericrocotus johnstoniæ* are

figured. This paper lists no new species but contains redescriptions of many species previously described in Bull. Brit. Orn. Club. *Geocichla andromeda* recorded as new to the Philippines. Four species, *Caprimulgus griseatus*, *Turdus obscurus*, *Anthus maculatus*, and *Anthus gustavi*, are noted as new to Mindanao.

Grant, W. R. O., and **Whitehead, J.**: On the nests and eggs of some rare Philippine birds. *Ibis* (1898), 231–247, pls. 5 and 6.

Short descriptions and measurements of the eggs of 36 species, mostly from specimens collected by Whitehead. The two plates illustrate the eggs of sixteen species.

Hargitt, E.: Scansores, containing the family Picidæ. Cat. Birds Brit. Mus. London (1890), **18**, 1–598, pls. 1–15.

Synonymy, keys, and descriptions of all the woodpeckers known at date of publication. The Philippine species figured are *Chrysocolaptes rufopunctatus* and *Thriponax pectoralis*. This book is essential.

Hartert, E.: Cypselidæ, Caprimulgidæ, and Podargidæ. Cat. Birds Brit. Mus. London (1892), **16**, 434–652, pls. 10–14.

Synonymy, keys, and descriptions of all swifts, night-jars, and frogmouths known at date of publication. Plates of *Caprimulgus griseatus* and *Lyncornis mindanensis*. Essential for a study of these families.

Hartert, E.: Die bisher bekannten Vögel von Mindoro, nebst Bemerkungen über einige Vögel von anderen Inseln der Philippinen-Gruppe. *Jour. für Orn.* (1891), 87–206, 292–302.

Notes on 68 species, mostly from Mindoro. The introduction contains a short account of the work done by Philippine collectors.

Kutter, F.: Beitrag zur Ornis der Philippinen. *Jour. für Orn.* (1883), 1–28 of reprint.

An annotated list of 54 species collected by Koch and Schadenberg at Sibulan, southern Mindanao. *Graucalus kochii* is the only new species. *Yungipicus maculatus* is added to the Guimaras list; *Collocalia linchi*, *Lanius nasutus*, *Hypothymis superciliaris*, *Zeocephus rufus*, *Dendrophila œnochlamys*, *Oxycerca everetti*, and *Excalfactoria chinensis* are recorded for the first time from Mindanao.

Salvadori, T.: Catalogue of the Columbæ, or pigeons, in the collection of the British Museum. Cat. Birds Brit. Mus. London (1893), **21**, 1–676, pls. 1–15.

Contains synonymy, keys, and descriptions of all doves and pigeons known at date of publication. *Osmotreron axillaris* is the only Philippine species figured. *Phabotreron occipitalis* is described as new. This volume is necessary for a study of the Columbæ.

Salvadori, T.: Catalogue of the Psittaci, or parrots, in the collection of the British Museum. Cat. Birds Brit. Mus. London (1891), **20**, 1–660, pls. 1–18.

Contains synonymy, keys, and descriptions of all the known parrots. The Philippine species figured are: *Tanygnathus everetti*, *Tanygnathus burbidgei*, and *Bolbopsittacus intermedius*, the last a new species. *Bolbopsittacus* is a new genus with *Psittacus lunulatus* Scopoli as the type. This volume is quite essential for the study of the parrots.

Salvadori, T.: Anseres. Cat. Birds Brit. Mus. London (1895), **27**, 23–93, pls. 1–5.

An important review of the ducks, geese, and swans with keys, synonymy, and descriptions. *Dendrocygna guttulata* is the subject of Plate I.

Salvadori, T.: On a rare species of lorikeet in the Rothschild collection. *Ibis* (1891), 48–51, pl. 3.

Description and plate of *Loriculus bonapartei.*

Salvadori, T.: On *Melaniparus semilarvatus.* *Ibis* (1879), 300–309, pl. 9.

Plate and notes on this species.

Salvin, O.: Tubinares (petrels and albatrosses). Cat. Birds Brit. Mus. London (1896), **25**, 340–455, pls. 1–8.

A review of this order with keys, synonymy, and descriptions. The only Philippine species is described on page 370.

Saunders, H.: Gavidæ (terns, gulls, and skuas). Cat. Birds Brit. Mus. London (1896), **25**, 1–339.

Synonymy, keys, and descriptions of all known species of gulls and terns. No Philippine species is figured.

Sclater, P. L.: Pittidæ and Eurylæmidæ. Cat. Birds Brit. Mus. London (1888), **14**, 411–449; 454–470.

Synonymy, keys, and descriptions of all the pittas and rollers known at date of publication. No species from either of these families is figured. This is an important work.

Seebohm, H.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Cichlomorphæ: Part II containing the family Turdidæ (warblers and thrushes). Cat. Birds Brit. Mus. London (1881), **5**, 1–426, pls. 1–18.

Synonymy, keys, and description of all species known in this group at the date of publication. *Locustella fasciolata* is the only Philippine species among the plates.

Sharpe, R. B.: Catalogue of the Accipitres, or diurnal birds of prey, in the collection of the British Museum. Cat. Birds Brit. Mus. London (1874), **1**, 1–480, pls. 1–14.

Synonymy and descriptions with keys of all species of eagles, hawks, etc., known at time of publication. The Philippine species figured are: *Astur soloensis, Astur cuculoides,* and *Baza magnirostris.* A necessary volume.

Sharpe, R. B.: Catalogue of the Striges, or nocturnal birds of prey, in the collection of the British Museum. Cat. Birds Brit. Mus. London (1875), **2**, 1–326, pls. 1–14.

Synonymy and descriptions with keys of all species of owls known at date of publication. No Philippine species is figured. A necessary volume.

Sharpe, R. B.: Professor Steere's expedition to the Philippines. *Nature* (1876), **14**, 297, 298.

A short account of Steere's first expedition to the Philippines and brief preliminary descriptions of ten new species: *Eurylæmus steerii, Phyllornis palawanensis, Brachyurus steerii, Æthopyga magnifica, Æthopyga shelleyi, Æthopyga pulcherrima, Arachnothera dilutior, Dicæum dorsale, Dicæum hypoleucum, and Dicæum hæmatostictum.*

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Coliomorphæ containing the families Corvidæ, Paradiseidæ, Oriolidæ, Dicruridæ, and Prionopidæ. Cat. Birds Brit. Mus. London (1877), **3**, 1–344, pls. 1–14.

Synonymy, keys, and descriptions of all species of the families named in the title. *Oriolus steerii* new species is the only Philippine species figured. An important work.

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Cichlomorphæ: part I containing the families Campophagidæ and Muscicapidæ. Cat. Birds Brit. Mus. London (1879), **4**, 1–494, pls. 1–14.

Contains keys, synonymy, and descriptions of the species in the families named. The work is important. No Philippine species is figured.

Sharpe, R. B.: A contribution to the avifauna of the Sooloo Islands. *Proc. Zoöl. Soc.* London (1879), 311–317.

Notes on 20 species mostly collected by Burbidge in the Island of Sulu. The new species described are *Tanygnathus burbidgii* and *Gallus stramineicollis.*

Sharpe, R. B.: A list of the birds of Labuan Island and its dependencies. *Proc. Zoöl. Soc.* London (1879), 317–354, pl. 30.

A list of 137 species largely from the collections of Low, Ussher, and Treacher, with valuable notes. The paper includes interesting references to a number of species which range to the Philippines.

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Cichlomorphæ: part III containing the first portion of the family Timeliidæ (babbling-thrushes). Cat. Birds Brit. Mus. London (1881), **6**, 1–422, pls. 1–18.

An important work on the first part of the *Timeliidæ* with keys, descriptions, and synonymy. The Philippine species figured are: *Iole rufigularis, Criniger frater,* and *Criniger palawanensis.*

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Cichlomorphæ: part IV containing the concluding portion of the family Timeliidæ (babbling-thrushes). Cat. Birds Brit. Mus. London (1883), **7**, 1–700, pls. 1–15.

An important work on part of the family *Timeliidæ* with keys, synonymy, and descriptions; no Philippine species figured.

Sharpe, R. B.: Description of a new species of hornbill from the Island of Palawan. *Proc. Zoöl. Soc.* London (1885), 446, pl. 26.

Description and plate of *Anthracoceros lemprieri*.

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Fringilliformes: part I containing the families Dicæidæ, Hirundinidæ, Ampelidæ, Mniotiltidæ, and Motacillidæ. Cat. Birds Brit. Mus. London (1885), **10**, 1–682, pls. 1–12.

Synonymy, keys, and descriptions of all the flower-peckers, swallows, and wag-tails known at date of publication. Philippine species figured are *Motacilla ocularis* and *Motacilla flava*. A very important volume.

Sharpe, R. B.: Notes on a collection of birds made by Mr. John Whitehead on the mountain of Kina Balu, in northern Borneo, with descriptions of new species. *Ibis* (1887), 435–454, pls. 13 and 14.

Cryptolopha montis new species, described.

Sharpe, R. B.: On a collection of birds from the Island of Palawan. *Ibis* (1888), 193–204, pls. 3 and 4.

A list of 129 species collected by Whitehead. Eight new species are described: *Prioniturus cyaneiceps, Baza leucopias, Syrnium whiteheadi, Scops fuliginosa, Hyloterpe whiteheadi, Siphia erythacus, Iole striaticeps*, and *Prionochilus johannæ*. Three of the new species are figured: *Syrnium whiteheadi, Siphia erythacus*, and *Prionochilus johannæ*.

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Fringilliformes: part III, containing the family Fringillidæ. Cat. Birds Brit. Mus. London 1888), **12**, 1–872, pls. 1–16.

Synonymy, keys, and descriptions of all the *Fringillidæ* known at date of publication. No Philippine species is figured.

Sharpe, R. B.: On the ornithology of northern Borneo. With notes by John Whitehead. *Ibis* (1889–1890.) Seven parts with pages and plates as follows: Part I, (1889), 64–85, pls. 2–4; part II, (1889), 185–205, pls. 7 and 8; part III (1889), 265–283, pl. 9; part IV (1889), 409–443, pls. 11 and 13; part V (1890), 1–24; part VI (1890), 133–149, pl. 4; part VII (1890), 273–292, pl. 8.

This important contribution to the ornithology of Borneo contains numerous notes on species which range to the Philippines. *Cryptolopha montis* is figured in part II, pl. 8. Part VII, pp. 274–285, contains a table of distribution showing the relation of the Bornean ornis to that of the surrounding islands.

Sharpe, R. B.: Catalogue of the Passeriformes, or perching birds, in the collection of the British Museum. Sturniformes, containing the families Artamidæ, Sturnidæ, Ploceidæ, Alaudidæ, also the families Atrichiidæ and Menuridæ. Cat. Birds Brit. Mus. London (1890), **13**, 1–702, pls. 1–15.

Synonymy, keys, and descriptions of the swallow-shrikes, starlings, weaver-finches, and larks known at date of publication. No Philippine species is figured. *Spodiopsar* new name, page 665, to replace *Poliopsar* Sharpe, preoccupied. *Munia cabanisi* new name, page 353.

Sharpe, R. B.: Coraciidæ, Meropidæ, Alcedinidæ. Cat. Birds Brit. Mus. London (1892), **17**, 4–312 pls. 1–12.

A review of the rollers, bee-birds, and kingfishers with keys, synonymy, and descriptions. *Ceyx steerii* is described as new. The Philippine species figured are *Eurystomus orientalis* and *Halcyon chloris*. This is a very important work.

Sharpe, R. B.: Rallidæ and Gruidæ. Cat. Birds Brit. Mus. London (1894), **23**, 1–228; 248–277, pls. 1–9.

The rails and cranes are described with keys and full synonymy. The work is an important one. *Rallina euryzonoides* is the subject of figure 1 on plate 8.

Sharpe, R. B.: Catalogue of the Limicolæ in the collection of the British Museum. Cat. Birds Brit. Mus. London (1896), **24**, 1–796, pls. 1–7.

A very important review with descriptions, keys, and synonymy of all the Limicolæ. No plates of Philippine species.

Sharpe, R. B.: Plataleæ (ibises and spoonbills) and Heroniones (herons and storks). Cat. Birds Brit. Mus. London (1898), **26**, 1–328, pls. 1–5.

An important review of these birds with descriptions, keys, and synonymy. The Philippine species figured are *Phoyx manillensis* and *Butorides spodiogaster*.

Shelley, G. E.: Capitonidæ and Cuculidæ. Cat. Birds Brit. Mus. London (1891), **19**, 13–121; 209–434, pls. 1–5; 11–13.

The parts of this volume indicated above, dealing with the barbets and cuckoos, include keys, synonymy, and descriptions of all species known at the date of issue. A useful and necessary work; no Philippine species is figured.

AN IMPROVED METHOD OF MODELING ESPECIALLY ADAPTED FOR THE CENTRAL NERVOUS SYSTEM.

(*From the Anatomical Laboratory, Philippine Medical School, Manila, P. I.*)

PREPARATION OF BRAIN MODELS.

By Maria Paz Mendoza and Manuel Ramirez.

During the last summer session of the Philippine Medical School, Dr. Bean recommended to us the study of the nervous system and suggested that in the dissection of the brain we make at least three different sections, sagittal, coronal (frontal), and horizontal, and take an exact copy of the two surfaces of each section on pieces of blotting paper,[1] cut out the ventricles and paste each two, which complete one section, together by means of small cubes of wood cut in such a way that the resulting thickness is just the same as that of the original section. The idea was to show the shape, size and relative position of the brain ventricles through the gaps left by the pieces of blotting paper pasted on the blocks, and on the blotting paper to show the internal structure of the brain. We adopted the suggestion and thought it capable of further improvement by substituting for the blocks of wood blotting-paper pulp, thus also gaining the external morphology and converting the work into true modeling. We found this to be an easy, economic, interesting and accurate work, the success of which is shown by the photographs accompanying this description.

PROCESS.

1. *Materials:* Blotting paper, white and onion skin paper, gum arabic and paints.

2. *Procedure:* Preparation of sections.

For coronal sections, an entire brain was taken from the preserving fluid,[2] held on a mass of cotton and ten sections of equal thickness made with a brain knife.

Sagittal and horizontal sections.—The brain is first divided into

[1] Sussana Phelps Gage: The Method of Making Models from Sheets of Blotting Paper. *The Anatomical Record.* (1907), 7, 166.

[2] Müller's fluid was employed so that the same material could be used for work on the histology of the brain.

halves, by making a cut through the longitudinal fissure, separating the brain-stem at the middle. One-half of the brain is then cut into four sagittal sections of the same thickness; the other half into four horizontal sections of the same depths. Thinner sections may be made, yet they are not desirable for beginners.

Making the pulp.—Waste blotting paper that has been used is pulled apart by hand [3] into small pieces and put into water to macerate, care being taken first to wash the mass two or three times. When the pieces become soft they are reduced to a fine pulp with the fingers. The surplus water is then squeezed out and the pulp thoroughly mixed with gum which has previously been dissolved.

Making copies of the contiguous surfaces of two adjacent sections.—The most anterior coronal section is first taken, held on a mass of cotton, the cut surface to be copied is then moistened with the preserving fluid and the onion skin paper immediately placed upon it. The structures beneath the latter are now plainly visible and their outlines can be followed with a sharp pencil, thus making an exact copy of the posterior surface of this section of the brain and the anterior surface of the next. When this part of the work is finished, two pieces of white paper with two of blotting paper are taken, the onion skin paper placed over them and the external outline of the section cut through them. The blotting paper is then set aside and two pieces of carbon paper inserted between the pieces of white paper in such a manner that when redrawn, the outline of the section on the onion skin paper gives two copies on the white, representing the two adjacent surfaces, one of this and one of the next section. By proceeding in the same manner with the remainder of the sections copies of their surfaces can be obtained.

Model preparation.—The work is now ready for modeling.

The two pieces of blotting paper, set aside in the last preparation, which correspond to the anterior and posterior surfaces, for example of coronal section number 2, are taken, the surfaces to be put in contact with the pulp are painted with thick gum and between them such a quantity of pulp, previously squeezed of its surplus liquid, is placed so that its thickness is about 1 millimeter, for every centimeter, more than the original section of the brain. The less the water and the more homogeneous the pulp, the less will be the shrinkage of the model in drying. The border is now made even throughout with fingers, forceps, and probes; once all the sections are thus made they are put together in their natural position and the rough outline of the most important and deep fissures such as those of Sylvius and Rolando and the longitudinal fissure are marked. Afterwards, taking each sec-

[3] Not cut with a scissors or knife.

tion individually, the sulci and gyri are worked out with the original section as a model, the two adjacent sections being occasionally consulted for their exact locations. Whenever the pulp dries too much it is moistened with a diluted solution of gum arabic.

Painting the model.—To distinguish the white from the gray matter and the different structures inside the brain from each other, water colors are used for all but the cortex, where oil is preferable. While the model is drying the two outlined pieces of white paper corresponding to section No. 2 are taken and with the original sections at hand the different parts are painted with different colors, giving the same color to those parts having the same or allied structure.

Last step.—When the model-sections are dried (which takes about one week, or longer, according to the water contained in the pulp), the white papers containing the copies of the surfaces of the sections are pasted on them and the gap left around the border, due to a slight contraction of the blotting paper, is filled up with pulp and left to dry. Next, the cavity for the ventricles is excised, as this can not be done when the pulp is moist, the newly exposed parts painted and after all is completed the outside is painted with oil colors. The same procedure is followed for the coronal sections and the sagittal and horizontal ones.

The record book.—A record book should be kept in which the onion skin papers containing the outlines of the internal structures should be preserved and to each of these the corresponding name should be given as their study is continued.

Experiments.—With the hope of further improving brain modeling we conducted some experiments the results of which are as follows:

Newspaper, macerated for three days in water, and reduced to a fine pulp of dark-gray color, has short fibers, but forms a soft mass easily workable into any desired shape. Painted with oil colors, almost no contraction occurs when drying and sections can easily be reduced to an 8 millimeter thickness.

With one-half newspaper pulp and one-half lime a pulp is produced that can be used to make sections 8 millimeters thick; this dries within twenty-four hours into a hard, strong, white mass with an even surface, which is easily painted. With gum the resulting mass is more plastic, but dries less quickly.

With one-third pulp, one-third lime and one-third sand, the mass is dark and dries more quickly, but it is brittle and not adapted for brain modeling.

We repeated the above experiments with magazine paper and ordinary white paper and obtained almost the same results.

This method of modeling can obviously be used for other purposes such as the reproduction of fruits, insects, etc., so that it can be made of advantage to botanists, zoölogists, paleontologists, etc.

PREPARATION OF BRAIN MODELS.

By Pio Valencia Enriquez.

The blotting-paper pulp is prepared as described in the work of Mendoza and Ramirez. The two hemispheres of a brain are then separated with a *sharp, thin-bladed knife,* and four vertical-longitudinal (sagittal) sections of one hemisphere made, the cuts being 1.5, 3, and 4.5 centimeters, respectively, from the mesial surface. The mesial section is then placed on the table and an exact outline of the structures found on each of its two surfaces drawn through transparent paper. Two pieces of blotting paper are cut from these outlines. A sufficient quantity of the macerated blotting paper is then put on the table, and compressed with a flat board until it becomes somewhat solid and nearly as thin as the mesial brain section. Its exposed surface is now ready for a coat of library paste which is first put on thin, then thick, and the proper blotting paper outline is then attached to this by compression. The other surface is treated in like manner and the remaining sections are made in the same way.

The exposed borders are then trimmed, the gyri, sulci, and ventricles being modeled while the material is soft and plastic, all exposed surfaces being coated with library paste.

Drying.—The models dry better in the shade than in the sunshine, rapid drying causing them to warp and to lose their shape. They should be placed in a closed locker over a pile of blotting papers on a plane surface. The model should be turned once or twice each 24 hours and the blotting papers should be replaced with dry ones at the same time, in order to facilitate the drying process. After the models are dry they may be painted in any way desired.

Caution.—All models made in this way must be preserved in closed cases, especially in the tropics, in order that rats, roaches, and other vermin may not mutilate or destroy them.

ILLUSTRATIONS.

PLATE I.

FIG. 1. Mesial surface of model of right hemisphere showing separation of sections. Mendoza and Ramirez.

2. Superior view of the first section from the base of the hemisphere. Mendoza and Ramirez.

3. Superior surface of the second section from the base of the hemisphere. Mendoza and Ramirez.

PLATE II.

FIG. 1. Coronal section number 5, showing the posterior surface. Mendoza and Ramirez.

2. Coronal section number 6, showing the posterior view. Mendoza and Ramirez.

3. Model of the right hemisphere of a human brain viewed from the side. Valencia.

PLATE III.

FIG. 1. Same as Plate II, fig. 3, with the first lateral section of the cerebral hemisphere removed. Represents a sagittal section 4.5 centimeters from the mesial surface. Valencia.

2. Same as Plate II, fig. 3, with the first and second sagittal sections removed. Represents a sagittal section 3 centimeters from the mesial surface. Valencia.

3. With the first, second, and third lateral sagittal sections removed. Represents a sagittal section 1.5 centimeters from the mesial surface. Valencia.

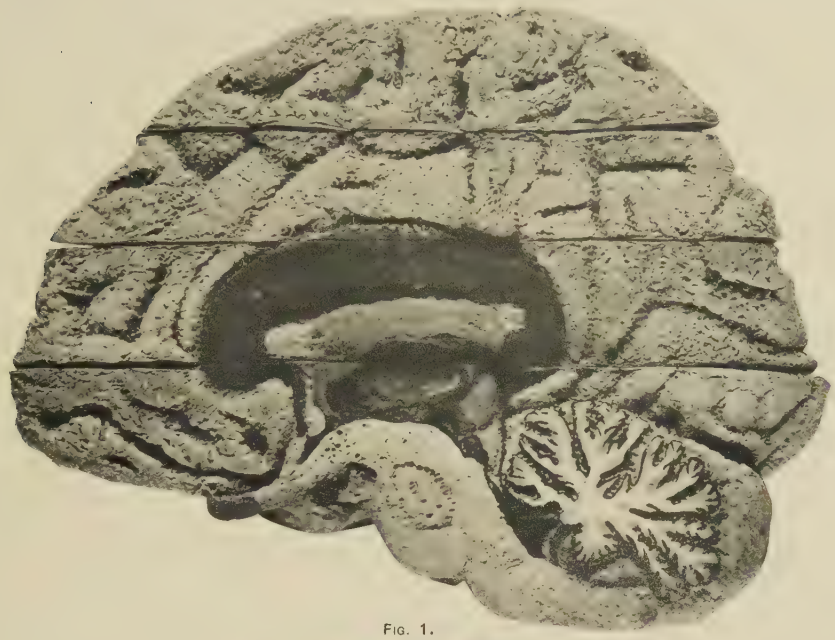

FIG. 1.

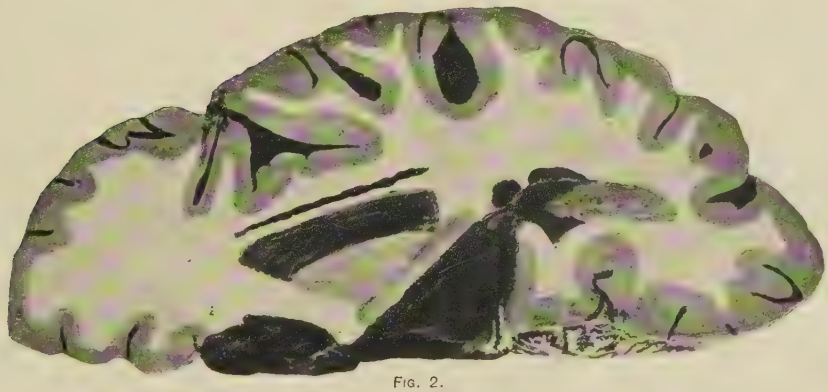

FIG. 2.

FIG. 3.

PLATE I.

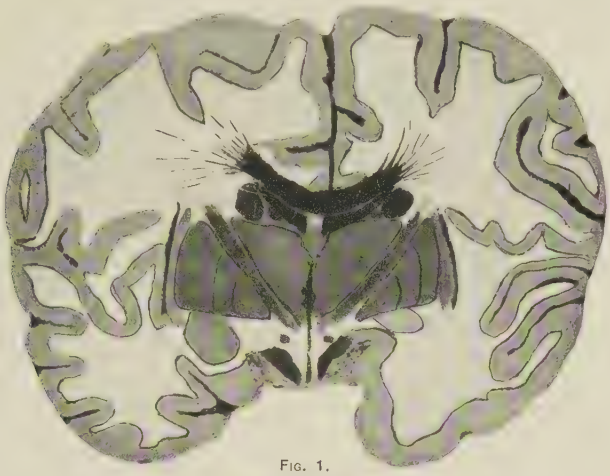

FIG. 1.

FIG. 2.

FIG. 3.

PLATE II.

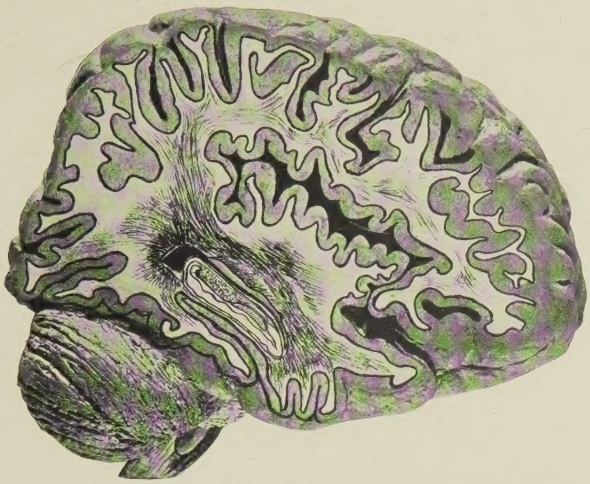

FIG. 1.

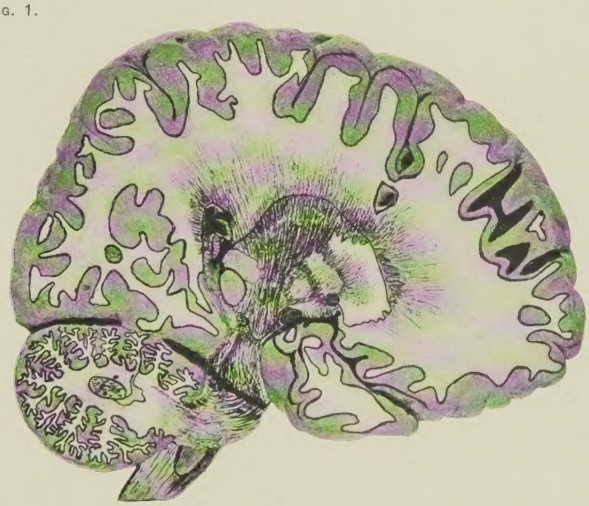

FIG. 2.

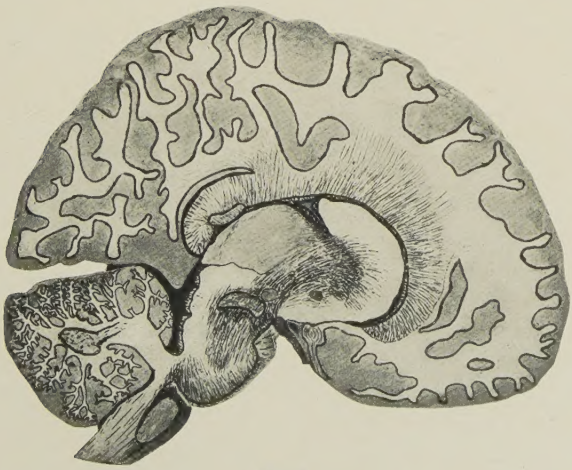

FIG. 3.

PLATE III.

EDITORIAL.

NOTES ON THE APPEARANCE OF SIREX JUVENCUS LINN. IN MANILA, P. I.

A few days ago a representative of a Manila importing house brought to this office an insect for determination which was found inside a packing case recently received from Germany. I have identified it as *Sirex juvencus* Linn.[1] This wood-wasp is common in Germany and is well known to foresters as injurious to *Pinus sylvestris* Linn.

The history of its introduction is as follows. A Filipino in opening a packing case noticed that about ten of the insects flew out, while at the bottom of the box several dead specimens were found. The packing case contained cotton underwear, packed in pasteboard boxes, and it was noticed that the insects had eaten holes in these inner boxes and had slightly injured their contents.

Unfortunately I did not see the packing case, but I have no doubt but that it was made of pine wood, in which the insects passed the last stages of their development. The wasps after hatching emerged on the inside of the box, and in attempting to escape attacked the contents of the box.

W. Schultze.

NOTES ON THE ABUNDANT APPEARANCE OF GIBBIUM SCOTIAS FABR. IN THE PHILIPPINE ISLANDS.

Some time ago Mr. Herbert S. Walker, chemist of this Bureau, called my attention to the fact that there were numerous beetles present in a material known as argol.[2] Upon investigation I found enormous numbers of a beetle which I have identified as *Gibbium scotias* Fabr., together with some specimens of *Tribolium ferrugineum* Fabr. The

[1] In German, "Die gemeine Kiefernholzwespe," see Ratzeburg, *Forst-Insecten* (1844), 3, 143, taf. IV, fig. 3.

[2] Argol (German, Weinstein) is a crude cream of tartar or potassium acid tartrate which forms as a crust on the inside of vessels in which wine has been fermented. The color is purple to white, according to the kind of wine. It is used as a reducing agent in gold and silver assays. The purified cream of tartar is used in medicine and to a large extent in the manufacture of baking powders. Our supply came in 50-kilogram barrels from a firm in New York.

50-kilogram barrel of argol was nearly full and throughout the mass it was infested with larvæ and cocoons of the first-mentioned species. As the barrel had been open for some time there was a possibility that the beetles might have entered it after it had reached Manila. I therefore examined a fresh barrel of argol which was kept in another part of the building. The outside of this package was in perfect condition and showed no signs of holes, but its contents were infested throughout. The surface of the argol was covered with a shiny mass of dead and living beetles of *G. scotias* Fabr. The above-mentioned facts convinced me that this species was introduced or imported with the argol from the United States. This species probably found suitable climatic conditions and multiplied rapidly. In the literature which I have consulted I find no mention of this species having been detected in argol, although it seems to have a somewhat peculiar sense of taste. Some authors mention it as feeding on the dust of granaries;[3] Laboulbène[4] found it on an Egyptian mummy in large numbers; Lucas[5] saw larvæ and adults feeding on red pepper (*Capsicum annuum* Linn.), and Stierlin[6] on the wool of sheep.

Should this beetle at any time adapt itself to food of more economic value and importance than the variety mentioned, serious damage might arise.

W. Schultze.

[3] Boieldieu, "Monographie des Ptiniores," *Ann. Soc. Ent. de France* (1856) (3), 4, 679.

[4] *Loc. cit.* (1872) (5), 2, 29 (Bull.).

[5] *Loc. cit.* (1884) (6), 4, 76 and 124 (Bull.).

[6] Calwer's *Käferbuch* (1893), 397.